THE AMERICAN ARCHITECT AND BUILDING NEWS



VOLUME XXI

JANUARY–JUNE

1887

TICKNOR & CO. PUBLISHERS.
211 TREMONT ST. BOSTON.

HELIOTYPE L. S. IPSEN DEL.

THE AMERICAN ARCHITECT AND BUILDING NEWS

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JANUARY—JUNE, 1887.

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THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, TICKNOR & COMPANY, Boston, Mass. No. 575.

JANUARY 1, 1887.

Entered at the Post-Office at Boston as second-class matter.

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THE preoccupation of mind attendant on bringing our year's operations to an end, and preparing for those of the ensuing year has caused us to overlook an announcement concerning the Gelatine edition, which should have been made at an earlier date. When the Gelatine edition was announced, subscribers were promised one gelatine print each month, which was full money's worth for the extra dollar paid for subscription. The success of the experiment proved the possibility of issuing more of these prints to those who would pay for them, and, following the example of the astute fisherman who wastes a sprat to catch a whale, we promised subscribers to this edition two gelatine prints each month during 1886, and, in fulfiling our promise, have served these subscribers at a loss to ourselves. As is known, the publication of the Imperial edition was begun in March last, instead of beginning to-day, as was our original intention, and as we landed our whale at that time, we really wasted the greater part of our sprat, and there is neither wisdom nor economy in continuing the operation. We shall return, then, to the original scheme of publication, and, henceforth, subscribers to the Gelatine edition will receive only one gelatine print each month.

A SUGGESTION, which may be of considerable value, seems to be contained in an article written by M. Léon Malo, which we find in *Le Génie Civil*, in regard to the formation of foundations for machinery by means of masses of concrete made with asphalt. Every architect who has had to provide for the placing of steam-engines or other pieces of heavy machinery knows that it is often a difficult matter to obtain a bed for them which shall have weight and inertia enough to be immovable under the straining of belts and the lateral movements of the various parts, together with the cohesion necessary to prevent gradual dislocation, without incurring serious expense, and to architects have been due many of the improvements and economies which have already been made in this detail of professional work. In general, the tendency has been of late years to substitute concrete for the masonwork of earlier times; and where the architect of twenty years ago would have hurried about among the stone dealers to find one or two enormous blocks upon which to secure, by means of bolts leaded into the stone, or passing entirely through it, the engine which his client wished to use, he now stays on the ground to watch the mixing of the cement concrete, which, if carefully made, gives at small expense, a mass of any size equal in resistance, and superior in inertia, to any combination of two or more stones, while it offers admirable facilities for securing the iron bed-plate of the machine by means of bolts embedded in the concrete before it hardens. According to M. Malo's plan, the cement concrete of ordinary use is simply replaced by a rough concrete of stones and asphalt, softened, as asphalt for such purposes usually is by the addition of seven or eight per cent of bitumen. To form the mass of asphalt concrete which it is intended to use as an engine-bed, a mould of planks is first formed, enclosing the form of the proposed block, and lined with paper to prevent adhesion. On the bottom of the mould is placed a layer of stones and asphalt, heated to about 400° Fahrenheit, and then other layers, allowing the larger stones to break joint as far as possible, and grouting constantly with hot asphalt, until the block is complete. The work may be interrupted for several days, and then resumed, without injury to the solidity of the mass, and cut-stone blocks can be inserted, or holes for bolts made by means of round sticks covered with paper, as the construction goes on. The mass of hot stone and asphalt must be allowed to cool for several days before the planks of the mould are taken away; but when all has set firmly the block forms an admirable, and almost indestructible foundation for any machine whatever. The asphalt concrete differs from solid stone, or from cement concrete, in possessing a slight permanent elasticity, so that a vibration communicated to one end of a block is absorbed, becoming imperceptible at the other end, and M. Malo finds that this quality gives it a remarkable advantage as a foundation for machines, which are found to run better, and keep in good order longer, on this than on any other bed. Whether coal-tar could be safely used in place of asphalt for a concrete of this kind we cannot say, but it seems at least probable that it might be, and the experiment seems to be well worth trying, particularly in places where high-speed engines are to be used. M. Malo calls attention to two precautions which it is necessary to take with the asphalt concrete, one being to protect it by a coating of cement, or better, we should say, of plaster-of-Paris, in places where it might be softened by too close proximity to a hot cylinder or steam-pipe; while the other is to avoid dropping oil on it, as all oils, and particularly the mineral oil used for lubrication, dissolve asphalt more or less completely. The same precautions would be needed with coal-tar concrete, and it might be well also to cover this all over with plaster-of-Paris or some other finish, to prevent not only softening, but the evaporation of certain volatile constituents which are present in coal-tar, but not in asphalt.

EVERY one remembers a rather striking letter, written to the *Century* a year or more ago, by some one who had become as tired of having carpenters, plumbers and glaziers in his house as Charles Reade was of "the curse of families, the British workman;" proposing that a new profession should be established, that of the Universal Tinker, the duty of whose members should be to know something of all the trades concerned in house-building, or rather, in house-repairing, so that they might be appealed to in all cases of functional derangement about a house, with confidence that they would know how to diagnose and cure the disorder at once and completely, without requiring the busy master or mistress of the mansion, on perceiving a leak in one of the water-pipes, to hunt up first a plumber to find the leak, then a carpenter to take up the boards to enable the plumber to reach the pipe, then the carpenter again to put back the boards after the plumber had done his work; and finally a painter to paint or varnish the dents and scratches which the plumber and carpenter had left behind them. This suggestion seems to have borne fruit, at least in Chicago, where the Universal Tinker Company has just been established, with a capital of twenty-five thousand dollars, for the purpose of undertaking household repairs systematically in just the way proposed in the *Century*. In order to avail themselves of the services of the company, it is only necessary for householders to pay a subscription, at the rate of three dollars a month, in return for which the company will send men once a week to the subscriber's house, who will do all the small repairs needed on the premises, testing the gas-pipes and water-pipes for leaks, and stopping any that may be found, setting lights of glass in place of broken ones, cleaning out waste-pipes and traps, refilling batteries and seeing that electric apparatus is in good order, winding and regulating clocks, protecting exposed water-pipes with straw or felt, with a thousand other small jobs of the same sort, which can be executed systematically by a company at much less than the expense of having the same work done by isolated workmen. The idea seems to have produced a great impression; two French journals have already copied a portion of the prospectus of the company from the American papers, and we shall expect to find it in others as the news spreads. So far, it meets with nothing but commendation, and if careful men are employed, who can be trusted to go about a handsomely-furnished house without leaving mud on

the velvet carpets and the damask furniture coverings, the company is likely to meet with great success.

AN account of the various experiences of architects and householders with workmen of the ordinary sort would fill volumes with stories which would amuse the reader more than the person whose sufferings they portrayed. Mr. Gardner and Mr. Holly have given several examples, but there are many more of the same kind. Perhaps the plumbers are the heroes of more anecdotes than workmen of any other sort. We remember one case where the proprietor of a house found some petty trouble in one of his plumbing fixtures, and, on his way down town, engaged a plumber to go to the house and make it right. When he came home in the evening he found almost the entire contents of his coal-bins, which were under the sidewalk, piled in the middle of the kitchen floor, and the plumber hard at work getting out what remained. The leak was still unrepaired, but the plumber explained that he was transferring the coal from the bins into the kitchen so as to get at the shut-off, which he supposed was in one of the bins; and it did not seem to occur to him that he had been doing anything foolish when he was shown the shut-off in plain sight on the kitchen wall. Perhaps the worst feat of the destructive workman that we ever came across was the setting of a tub, consisting of half a lime barrel, nearly full of mortar, on the beautifully polished marquetry floor of a room in which some trifling repairs were to be made to the plastering. This tub, which, of course, leaked at all its joints, was left standing in the middle of the floor over Sunday, and when we saw it, it formed the centre of a mass of brown stains, which extended over the floor in every direction.

MESSRS. ANDREWS & JAQUES, architects, of Boston, write to the *Sanitary Engineer* in regard to a matter of very considerable importance to architects and owners. It seems that these gentlemen, not long ago, had occasion to number temporarily certain rooms in a house to be altered under their care, and for this purpose used paper numbers, which they pasted on the glass of the windows with mucilage. Later, when they attempted to wash off the numbers, they found that the mucilage had left a stain on the glass, which could not be removed. They applied for advice to a chemist, who informed them that the mucilage contained silicate of soda, and that nothing but repolishing the glass would remove it. The glass dealers who heard of the matter said that they had themselves met with similar accidents in pasting on their labels, and that nothing could be done but to repolish the glass. The mucilage manufacturers gave the architects some comfort by telling them that if the windows were treated with hot water the silicate stain would come off, and this proved true for the sheet-glass windows, but the stains on the plate-glass did not yield. The editor of the *Sanitary Engineer* seems to have no suggestions to make in regard to the trouble, and we doubt if any one knows of a treatment which will take off such stains from plate-glass. With us silicate of soda and glass windows do not often come in contact, but it was at one time common abroad to give house walls of porous brick or stone a coating of silicate of soda, sometimes alone, but more often followed by chloride of calcium or other reagents, in order to prevent them from absorbing moisture. It was soon discovered that in applying these "preservative solutions" care must be taken to keep the silicate of soda from spattering on the windows, and the printed descriptions of the various processes usually contained directions for covering them, so as to avoid the "indelible stains" produced by the solution; but the presence of this chemical in mucilage could hardly have been suspected even by those familiar with the precautions to be taken in applying preservative solutions; and the manufacturers of the mucilage, who must have known the effect of silicate of soda on glass, would have done well to print on their labels a warning against what is certainly a very common use of their product.

M. DE MERITENS, a distinguished electrician, has just announced the discovery of a process for covering iron and steel, by means of an electric current, with an unchanging coating. By the aid of electricity a perfectly pure iron has been obtained, which is as little subject to corrosion as copper, but this metal is too costly for general use, and so far the only way in which electric currents have been found of practical advantage is in producing upon the outside a covering of magnetic oxide, similar to that given by the hot-air or steam of the Bower-Barff processes. The manipulation necessary is the same as that for electro-plating. The piece of iron to be coated is cleaned, and placed in a bath of water, warmed to a temperature of about one hundred and seventy degrees Fahrenheit. The piece to be coated is made the anode, and a piece of copper, or of carbon, or even of iron, serves as cathode. On passing a gentle current through the circuit the water surrounding the iron under experiment is decomposed: the hydrogen accumulates on the cathode, while the nascent oxygen acts upon the metal of the anode, covering it with a shining black coat of magnetic oxide. If the current is too strong, the coating is powdery, and liable to rub off, while the surface of the iron is roughened by a sort of honey-combing action; but with a moderate one a perfectly adherent black coating is formed in a few minutes, which can be brilliantly polished. Moreover, by the chemical action of the decomposed water pieces of iron already deeply corroded may be cleaned and permanently protected from further corrosion by a single operation. To do this, according to *Le Génie Civil*, it is only necessary to place the rusty iron in the bath, and send a gentle current through it. As before, the decomposition of the water of the bath in contact with the iron sets up a chemical action, but in this case the hydrogen as well as the oxygen of the water is engaged, and the sesquioxide of the rust is reduced to magnetic oxide, at the same time that a further oxidation seems to take place in the pores of the unchanged metal. The result of all the reactions is to produce a black skin upon the piece of metal under treatment, the outer portion of which is rather loosely attached to the rest, and can be brushed or scraped away, while the inner portion clings tightly, and is as hard as the iron itself. If distilled water is used for the bath, and in other respects a suitable cleanliness is maintained, the coating given by the electric process is more uniform than that produced by the action of hot-air or steam, and is quite as hard and adherent, while its production is a matter of a few hours, instead of days.

THE *Deutsche Bauzeitung* gives some details about the two newest engineering improvements proposed in Switzerland. One of these, the Brunig railway, is already, we believe, under contract. The road is to be of narrow gauge, the rails being one metre, or thirty-nine inches apart, and is to be divided into three sections. One of these comprises the line from Brienz to Meiringen, while the second forms the opposite end of the route, extending from Alpnach, on the Lake of Lucerne, to Lungern, a village at the foot of the pass of the Brunig. The third section is the mountain line, which passes over the Brunig and connects the other two. For this last portion it is intended to use a toothed rail, midway between the others, into which will lock the teeth of a cog-wheel on the engine, as is done on the Mount Washington railway and others of the kind. Without such help it would be impossible to ascend or descend the grades of the Brunig line, some of which rise at the rate of six hundred and thirty-four feet to the mile, and even with it the road will only be traversed in summer, leaving the winter traffic between the two valley sections, which are to be kept open throughout the year, to be carried on over the mountains, as it now is, by means of sledges. The second enterprise of the kind now under consideration is the construction of a carriage-road over the pass of the Gemmi. To judge from our own experience of both passes, the engineering of the Brunig railway will be child's play compared with that required for laying out a road over the other route, which begins, just above the baths of Lenk, by the ascent of a cliff, more than four hundred feet high at the lowest place, of which the top is said to overhang the base. We will not warrant the truth of this, but we can testify that the zigzag path hewn out of the face of the rock projects in some places considerably beyond the portions of the same path immediately below, and it is hardly conceivable how anything short of a spiral tunnel, like those which ascend the Saint-Gothard mountain, could be contrived to get carriages to the top of the cliff. Once over this barrier, which is so formidable as to have kept for many thousand years the people on either side of it completely distinct in race, language, religion and manners, the ascent of the Gemmi is not extremely difficult, but the pass is very high, and much exposed to snow, so that, however desirable it may appear to the Swiss Government to establish more direct communication between the valley of the Rhone and the German-speaking Switzerland, we are not sure that the object might not be as well attained by making a special cheap railway fare around the mountains as by the more romantic expedient of hewing a road through or over them.

EARLY SETTLER MEMORIALS.[1] — V.

GROTON HEIGHTS CELEBRATIONS AND MONUMENT.



The Groton Monument.

THE sad anniversary of the massacre at Groton Fort was celebrated for many years with sad solemnity. Within the enclosure of the old wall of the fortress, where the victims had been heaped up and the blood flowed around in rivulets, sermons were annually preached and all the details of the terrible event rehearsed. In the year 1789, Rev. Henry Channing of New London delivered the annual sermon. His text was: "If thine enemy hunger give him bread to eat; if he thirst, give him drink." Unlike the usual tone of such discourses which had served to keep alive the memory of the country's wrongs, the speaker recommended forgiveness, peace, and reconciliation.

Through the effects of this sermon, or the division of public sentiment from some other cause, the celebrations were discontinued for many years. In course of time, however, a desire became prevalent — not to revive the embittered feeling of revolutionary days — but to erect some enduring memorial of the heroism and unfortunate end of the Groton victims. A general spontaneous utterance of this wish led to a celebration of the anniversary of the battle-day in the year 1825. The orator was William F. Brainard, Esq. A grand military parade and a large assemblage of citizens gave effect to the sentiment then expressed, that a monument to the memory of the slain should be erected near the scene of the fatal assault. The published account of this celebration contains the surprising expression that the battle "had hitherto been deemed unworthy of commemoration." Tradition says that at least ten thousand people attended this celebration, including the military and eighteen survivors of the massacre, disfigured by scars, maimed by wounds, and wearing the clothes they wore in the fight, which were perforated by bullet holes and bayonet cuts.

Immediately behind the orator sat three veterans, and behind them one thousand ladies who, with tearful eyes and glowing hearts, showed their appreciation and gratitude to these brave men. The scene is described as most solemn, affecting and impressive, where more of tears than mirth prevailed.

In accordance with the sentiment expressed at this celebration, sixty citizens of Groton and New London formed themselves into an association for the purpose of erecting a monument on Groton Heights. Each member paid an entrance fee of two dollars, except the survivors of the battle, they were admitted free. The first by-law of the association stated that "any *white* male person may become a member." In the horrors of battle the negro's services are welcomed, but in times of peace he is told that he is not wanted. A charter was granted to the association by the legislature in 1826, and the latter body was asked to assist in the erection of the monument.



Design for a Monument on one of the battle-fields near Paris. MM. Sauffroy and Vionnois, Architects.

At one of the first meetings held to devise means to erect the monument, and after the matter had been fully examined and discussed, the sense of the meeting was tried, and it was unanimously agreed: "that the events of the 6th of September, 1781, possessed that general interest, that justly entitled them to the respect of our country at large."

The petition to the legislature for this aid is a very remarkable document, and its general character is illustrated by the following extracts:

"In asking for the means for erecting a monument, they do not propose to gratify the narrow feelings of pride and vanity, nor even to cherish a remembrance of private excellence and worth, but to animate and keep alive a recollection of an interesting event of our Revolutionary War, and strengthen the remembrance of the brave men who were actors in it."

As to the propriety of raising a monument, they say: "And if it should still be considered a question whether the method is a wise and proper one for commemorating a distinguished event in our history, it might be deemed a sufficient answer that such has been the usage of all nations whether barbarous or civilized, in every age of the world. But without resorting to the sanction of usage, your petitioners believe they may safely refer the points to be decided by the principles and feelings of our common nature." As to the matter of art in the monument, the petitioners stated their feelings with singular honesty, if not with a very deep understanding of what really makes a monument. This is what they say:

"We are not ambitious that it should possess the fine symmetry and proportions of the Grecian and Roman models, nor exhibit a display of the sculptor's skill; these things, though fine in themselves, are too apt to attract more admiration for the artist than for the event intended to be commemorated. But in the qualities of simplicity, strength and durability, it cannot too much abound. The best skill of the mason should be employed to make the monument endure as long as the hill on which it is to stand. And the only business of the sculptor should be to mark upon it in plain and indelible characters, the names and deeds of the brave sufferers of the 6th of September, 1781." In closing their petition, the signers add this curious sentence: — "In presenting their case to the consideration of the Legislature, your petitioners feel sensible of the great embarrassment that ordinarily attends those appearing in the character of suppliants for public bounties; your petitioners cannot but express their hopes that the present application is not of that ordinary kind which excites little interest, and which merits as little as it excites." Some of the members of the Legislature favored a State appropriation of $15,000, though it was unanimously agreed to authorize a lottery to raise a sum not stated. The managers of the lottery were David Coit, S. F. Dennison, E. F. Smith, T. P. Trott and W. W. Law. They published the first scheme August 2, 1826.

Their highest prize was $5,000, the lowest $3.00, and the whole amount of prizes $25,000. "This lottery," they advertised, "will be drawn in the *good old way*, in which no intricate combination of numbers can be used. The noble purpose for which the lottery is granted ought of itself to secure the countenance and support of the public; but in addition to a motive of patriotism, adventurers have in this scheme a favorable opportunity to enrich themselves."

The corner-stone of the monument was laid September 6, 1826, with Masonic ceremonies by the Grand Lodge of the State, in the presence of many men of distinction, the military, and a large concourse of people. It was completed in 1830. It is not known that any architect was employed in its design, or who the master-builder was. There was a building-committee. It is built of native rock, quarried not far from the place where it stands; is twenty-six feet square at base, twelve at top, and one hundred and twenty-seven high. In the interior a circular flight of one hundred and sixty-eight steps leads to the platform on the top, from whence a fine view is obtained.

The monument cost $11,000. It stands a short distance from the old fort. Its style is described as that of an obelisk. The top is two hundred and sixty-five feet above the waters of the bay.

Upon a marble slab on the west face, over the entrance, is the following inscription: —

"This Monument was erected under the patronage of the State of Connecticut, A. D., 1830, and in the 55 year of the Independence of the U. S. A. In Memory of the Brave Patriots who fell in the Massacre at Fort Griswold near this spot on the 6 of September, A. D., 1781, when the British under the command of *the traitor Benedict Arnold*, burnt the towns of New London and Groton and spread desolation and woe throughout this region."

The most striking line of the inscription — emphasized as it were in large capitals — is THE TRAITOR BENEDICT ARNOLD. It seems as though the builders of the monument having set out to honor the memories of the departed heroes, had been so carried away by the flood of their patriotic indignation when they came to the mention of Arnold's name, that they hurled the whole weight of the monument upon him, and left the memories of the heroes — as indeed they might — to take care of themselves. Perhaps they thought it wise to make his infamy monumental, as a warning, instead of glorifying the services of better men as examples for posterity. However that may be, the monument is obviously more commemorative of Arnold's treason than of the patriotism of the men who fell. Not that the latter are omitted entirely.

Within the monument, upon the right of the entrance, is a marble tablet bearing the names of the eighty-three heroes who fell on that bloody day, and the proverbial Connecticut thrift is suggested by the charge of ten cents admission to see them. You get the Connecticut opinion of B. A. for nothing. By paying ten cents you can read the names of the martyrs.

This was formerly on the south side of the monument, facing the fort; some years since, repairs becoming necessary, it was removed to the present location, and its place supplied with solid masonry. There was also above and connected with it a slab bearing the following inscription, which was also removed at that time and never replaced: —

"Zebulon and Naphthali were a people that jeoparded their lives

[1] Continued from page 265, No. 571.

unto the death in the high places of the field" — Judges, 5 chap. 18 verse.

The monument is fitly described in the words of the association's petition to the Legislature: "We are not ambitious that it should possess the fine symmetry and proportions of the Grecian and Roman models." It is simply a piece of masonry, and as far from being a monument as its entire dimensions are greater than a single stone used in its construction. There was a vital sentiment and a universal character in the Indian memorial, gradually accumulated by personal and spontaneous effort on Sachem's Plain, that touched every one, be he savage or civilized. Even though the object for which it was piled up be hidden in the greatest uncertainty, its appeal to the heart is not a particle diminished. It stood there for the best loyalty of remembrance to a human existence. What a falling off in sentiment, of appreciation of what was due to the event was there in the minds of the men who caused the erection of the Groton shaft, in comparison with that expressed by the penniless widows in their memorials. The cruel and careful discrimination made by the petitioners, when they said that "they do not propose — even to cherish a remembrance of private excellence and worth, but to keep alive a recollection of an interesting event of our Revolutionary War" could not have been thought of by a savage. The old gravestones are complete and beautiful memorials. The Groton Monument is the most heartless pile of stone ever built up to any object deserving monumental remembrance. From every point of view from which real monuments are to be considered, it would have been better for those who made it and for the generations who succeed them, if it had never been built.

The desire of the men who made this monument, that it should not be a work of art, for fear that it would distract attention from the memory of the heroic dead, displays an ignorance only equalled by their belief that the skill of the mason and an enduring pile of stone would alone commemorate the event, or "strengthen the remembrance of the brave men who were actors in it." They knew that it had "been the usage of all nations," whether barbarous or civilized, in every age of the world, to commemorate memorable events by great monuments; but they failed to observe that these structures were distinguished by qualities as notable in themselves as the events they signalized; qualities quite beyond the reach of the mason, and still more enduring than stone. If the Groton Monument Committee had followed the usage of their savage predecessors, piled up their native pieces of granite as spontaneously as did the Indians on Sachem's Plain, and with a modest rustic taste trained the wild vines of the forest to grow over them, they would have shown an understanding of the lessons which the usages of all nations — worth referring to — teach, and answered to the full all "the principles and feelings of our common nature."

The Groton Monument does not, however, stand alone in its shocking and ineffectual presence as a commemorating object in discordant relationship with the event it assumes to keep alive. It has a fitting counterpart near by in the Norwich images, and hundreds of others scattered all over the States of the Union. If the idea of the sculptor's art in Groton was the same in 1826, as it was in Norwich in 1871, than the Groton obelisk, in comparison with the granite soldier, needs no apology and deserves no condemnation. Since the erection of the monument the anniversary day has been usually noticed by gatherings on the spot of individuals, and sometimes by prayers and addresses, but not often by a public celebration. Mr. Jonathan Brooks, of New London, who died in 1848, took a special interest in this anniversary. For many years before his death, he resorted annually on this day to Groton Heights, and whether his audience was few or many, delivered an address, which was always rendered interesting by graphic pictures and reminiscences connected with the Revolution. On one occasion when he found himself almost without an audience, he exclaimed with sudden fervor, "Attention! Universe!"

THE LEDYARD MONUMENT.

In 1854, the State appropriated $1,500 for the erection of a monument to Colonel Ledyard. It was made of native granite, and bears his name, and stands in the cemetery which is situated within a few hundred yards of the fort. Within the iron railing that encloses the monument are the remains of the slab of blue slate which originally marked his grave; it is now nearly destroyed, and the inscription rendered illegible by the vandalism of the relic hunter. On the die of the monument is the following inscription: —

"Sons of Connecticut behold this monument, and learn to emulate the virtue valor and Patriotism of your ancestors. Erected in 1854 By the State of Connecticut in remembrance of the painful events that took place in this neighborhood during the war of the Revolution; It commemorates the burning of New London, the storming of Groton Fort Massacre of the Garrison and the slaughter of Ledyard the brave Commander of these posts who was slain by the Conquerors with his own Sword. He fell in the service of his country Fearless of death and prepared to die."

On the north side of the die is a copy of the inscription on the head-stone originally erected over the grave of Colonel Ledyard. It read as follows: —

"Sacred to the Memory of William Ledyard Esq, Col[l] Commandant of the Garrisoned Posts of New London & Groton; Who after a gallant defence, was with a part of the brave Garrison, unhumanely Massacred; by british troops in Fort Griswold, Sep 6 1781 Æ tatis suæ 43.

"By a judicious & Faithful discharge of the various duties of his Station, He rendered most essential Service to his Country; and stood confessed, the unshaken Patriot; and intrepid Hero.

"He lived, the Pattern of magnanimity; Courtesy and Humanity. He fell the Victim of Ungenerous Rage and Cruelty."

The monument itself is one of the kind that owes its origin to the marble-cutter. As a memorial it has no interest whatever in comparison with the battered remains of the old stone.

The vest and shirt worn by Ledyard at his death are preserved in the Athenæum at Hartford. They bear the rents made by his own sword in the hands of his murderer. These, and the noble inscriptions, are his only monuments. The one on the monument ought to be engraved on a tablet of gold. Not to encourage the sons of Connecticut "to emulate the valor and patriotism of their ancestors," for they need no such encouragement, but to shame, by contrast, the weak sensibilities of a committee who would erect such an object as that over Ledyard's grave.




The Ledyard Monument and Gravestone, Groton, Conn.

Inside the old fort, a few steps from the entrance, a slab, enclosed by an iron fence, bears this inscription: "On this spot Colonel William Ledyard fell by his own sword in the hands of a British officer to whom he had surrendered in the Massacre in the Fort, Sept. 6, 1781."

THE LITERARY MONUMENT.

The book called "*Battle of Groton Heights*," first published, with many illustrations, by Wm. W. Harris, Esq., and enlarged and revised by Charles Allyn, Esq., both of New London, is, after all, the only monument, excepting the old gravestones, worthy the slightest attention. It is a human, just and tender tribute; beautiful in its appreciation of the subject; thorough in its purpose, and of inspiring interest. The chapter devoted to "Monumental Records," contains excellent illustrations of twenty-six of the fifty-two of the old gravestones, and thirty inscriptions and epitaphs; the histories of the families of the slain; the narratives of those who survived the slaughter, with their biographies, are given with minute fulness. We are gratefully indebted to this book, the best one we have ever seen on such a subject, for aid in the preparation of this paper, as we are also to John J. Copp, Esq., of Groton, Conn.

FORT GRISWOLD.

The old fort has changed very little. It is substantially the same in size and outline as at the time of the battle. The flag-staff raised in 1881, stands as nearly as possible on the spot occupied by the old one. The well is the same, whose cooling waters the implacable British refused on that bloody day to the dying defenders of the surrendered fort.

THE NEGRO HEROES OF FORT GRISWOLD.

That there were two free negroes, Lambert Latham and Jordan Freeman, among the garrison of the fort, who fought as desperately as the white men, and were both killed, has not always been noticed by historians and orators. Freeman, who was the body-servant of Colonel Ledyard, is credited with killing with a spear Major Montgomery, the commander of the assaulting forces, as he was about to jump on to the wall of the fort from the shoulders of his soldiers. As the Major breathed his last, he cried, "Put every man to death." Freeman was buried in the cemetery of the Ledyard family.

Lambert Latham lived with Captain William Latham, and just before the attack on the fort was sent off with Mrs. Latham, her children and servants to a place of safety; but seeing a musket in the wagon, he took it and hurried back, following the Captain into the fort. The Latham family say that Lambert fought manfully by his master's side, discharging his musket with great rapidity, even after he had been severely wounded in one of his hands. On the tablet in the monument where the names of the slain are inscribed those of Freeman and Latham are placed *last*, with a wide space between them and those above, and the latter is given as Sambo. At the seventy-second anniversary of the battle in 1853, the Hon. Robert C. Winthrop was the orator. His omission to make a brief allusion, even to the two colored soldiers, though speaking in strains

of eloquence of the Sons of Connecticut, called out from Mr. Wm. Anderson, a colored citizen of New London, a reproof for this neglect, a reference to the manner of cutting Lambert's name on the monument, and an account of his tragic death. Mr. Anderson's article was published in 1855, in a book called "The Colored Patriots of the Revolution." He says: — "Lambert was a brother of my grandmother. He was near Colonel Ledyard when he was slain, and retaliated upon the British officer by thrusting his bayonet through his body, and received in return from the enemy thirty-three bayonet wounds, and thus fell, nobly avenging the death of his commander. These facts were given me on the spot at the time of laying the corner-stone by two veterans who were present at the battle."

No confirmation of this statement of the death of Lambert was made in the published narratives of other witnesses of the massacre.

The following epitaph is from the oldest gravestone in New London, erected to the memory of Captain Richard Lord, who died in 1662: —

> "Bright starre of our chivallerie lyes here
> To the state a counsillor full deare
> And to ye truth a friend of sweete content
> To Hartford towne a silver ornament
> Who can deny Is Poore, he was relief
> And in composing paroydies he was cheife
> To Marchantes as a patterne he might stand
> Adventring dangers new by sea and land."

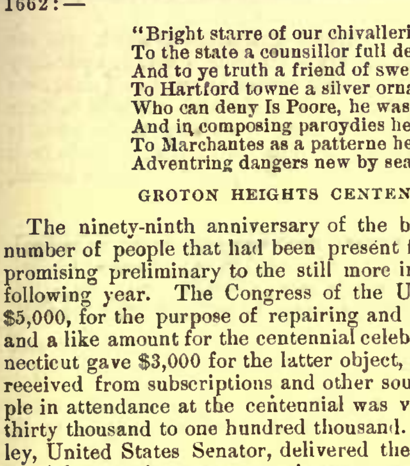
GROTON HEIGHTS CENTENNIAL, 1881.

The ninety-ninth anniversary of the battle collected the largest number of people that had been present for many years, and was a promising preliminary to the still more imposing celebration of the following year. The Congress of the United States appropriated $5,000, for the purpose of repairing and improving the monument, and a like amount for the centennial celebration. The State of Connecticut gave $3,000 for the latter object, and over $3,000 more were received from subscriptions and other sources. The number of people in attendance at the centennial was variously estimated at from thirty thousand to one hundred thousand. General Joseph R. Hawley, United States Senator, delivered the oration. During the centennial year, important repairs were made to the monument, its height increased eight feet, and the summit completed in proper proportion to the rest of the monument. The association was also revived through the efforts of Mr. E. L. Avery and Mr. John J. Copp, and a large number of names added to its membership.

T. H. BARTLETT.

[To be continued.]

THE ETHICS OF ARCHITECTURAL PRACTICE.[1]



BY the ethics of architectural practice you will understand, with me, that courtesy and consideration which persons of the same profession not only should practise, but which they owe to one another. In other words, it is the golden rule of life, "Do unto others as you would be done by."

All occupations, every trade, call it what you will! yea, the foundation of all life and mutual dependence, exist under this moral obligation, and, without it, earth would be but chaos.

Without the cognizance of this bond, from which no one is free, or can absolve himself, and its enforcement or compliance therewith, no industry can flourish, no craft can thrive; and the higher the morale, the more exacting the standard and its observance, the greater must and will necessarily be the resultant good.

If in the ordinary avocations of life this code is requisite, it is infinitely more essential to the arts. The product of the manufacturer, the wares of the merchant, represent, embody a value, a cost of production and of handling, that is positive and cannot be annihilated. The labor of the scientist, be his special pursuit what it may, is the product of his mind, which, once transformed into substance, goes forth beyond recall, to enrich some one possibly, but may leave him "poor indeed."

What constitutes the code of ethics of our profession? Is there a written law to govern? Is there established usage to guide? Is there a power to protect? Exists there a tribunal to decide?

You will say my questions are numerous, and, like many cases, it may be much easier to ask than satisfactorily to answer. Craving your indulgence, I will attempt it.

Ethics, as I understand its import, is the science that treats of human actions, right or wrong, in the practice of human life. As we all are probably and unfortunately painfully aware of many of the wrongs, I will at present confine myself to speak of the right — of what should be, not what in many cases is. If the above definition is correct, then the written law, if such there be, must have been the result of, and formulated by such practitioners as were upright and honorable, their action and conduct gave it credence, merited approbation, and established it as proper usage. Strictly speaking, in the light we are considering, there cannot be such a thing as a law, emanating of and by itself; it is that innate feeling of honor, self-respect, and of the esteem and protection which we desire to gain for ourselves, that actuates and prompts us to render it to others if we would exact it in return; this makes usage, usage makes law.

The art of all arts, for apart from its sister Music, it is the only art creative, and, in comparison with the evanescent character of the former, fitly called "frozen music," with its memorials to mark every epoch, from Pyramid-studded Nile and the rock-cut temples of India to the monuments of to-day, graving each people's history in enduring stone, for the instruction, wonder and admiration of future ages and generations, has not rolled by, nor its illustrious achievers, honored and rewarded by emperors, kings and pontiffs, lived, without leaving us their legacy. What the usage was in times gone by, is not the object of this paper. Its purpose is, what are its recognized usages to-day?

Every practitioner will tell you they are those universally known and embodied in the constitution and schedule of the American Institute of Architects and other kindred associations. And what are the American Institute of Architects and its kindred associations? They are a connection of architects for the honorable and dignified prosecution of their profession, on a uniform and reputable basis.

Have these institutions, entrusted with our mutual welfare, a duty to perform? Do you smile at the simplicity of the question?

I think you will agree with me that they have, that their existence is due to a desire, and their paramount duty is to see, that all of its individual members comply with the honorable, the dignified, and reputable usages and practices of the profession they represent; and just to the extent to which they fulfil this mission, is it in their power to improve, or on the contrary to debase it.

If, then, we have such associations, and our united presence here on this occasion, and others gone before, and others that will follow, proves that we have, then have we also a power that should protect, a tribunal that should decide; and if it fails so to protect, fails so to judge, then can it neither expect, much less command either public respect, or individual confidence, still less recognition or obedience.

Do the various members of these bodies comply with their obligations to the profession and its representatives? In other words, do they fulfil what they promised, worthily uphold what they agreed to when they joined in fellowship?

I should like each member to answer this question for himself, but I will here venture the assertion, in which I think every honorable member will join with, and bear me witness, that fully one-third of all the members of the various organizations are simply associated therewith to use the same for a cloak, and but too often as a weapon against their more honorable confrères.

Is there unity of action or of practice amongst us, as there should be between members of a common cause, with common interests, and for a common good? Are we actuated by a common zeal and common friendship? Or, do you not rather find in the place of confidence that should exist, mistrust; in the place of amity and good-will, jealousy and envy; in the place of honorable consideration and support, selfishness and indifference? Does not the motto, instead of "Truth and Unity," seem to read "Every man for himself, and the devil take the hindmost?"

When members not only of the profession but of the association besiege a person who contemplates making an improvement, for whom, in many cases, an architect has done previous building and is his choice, and offer, aye, beg for the privilege, and exert influence to secure this, to make drawings free of charge if not adopted, and at ridiculous commissions or remuneration if chosen, well knowing that by such means alone they can find entrance, do they elevate the profession or add lustre to the Institute which tolerates it?

Or, when an architect is engaged, plans are prepared and in the hands of his client, another goes to him and offers to do the work at one-half rates, and if he finds response, possibly takes your drawings to his office and makes copies of them, and you can only secure yourself against his assault by threatening your quondam client with a suit at law, does this look as if the morale of the profession has an honorable standard?

Or again! when an architect has a commission promised for a work in the near future, the regular commission on which would amount to between seven and nine hundred dollars, and when about ready the supposed client informs him that, owing to certain influences which he cannot ignore, he feels compelled to ask another architect what he would be willing to do the work for, and when the architect, once employed, informs his opponent of the facts, and that his proposition has been made in accord with the schedule of the American Institute, and, a few days after, the first mentioned is shown a proposition in writing, signed and submitted (possibly in a spirit of pique) by the latter offering to furnish full service required for the sum of fifty dollars, and this also by a member of the American Institute, does it show unity and interest in the promotion of good?

Or again! when a member of the Institute proclaims as a medium

[1] A paper by Geo. A. Frederick, F. A. I. A., read at the Twentieth Annual Convention of the American Institute of Architects, held in New York City, December 1 and 2, 1886.

of influence that he charges only one-half commissions on all ecclesiastical work for a certain denomination, and thus securing the bulk of it, frequently makes the business relations of other architects with their clients for this class of work very much strained and unpleasant, they (the clients) feeling when informed of this, that they have been or are being taken advantage of, can this be productive of fellowship and harmony?

I have often heard it asserted that a man's labor is his, to do with as pleases him, can be given away if he so chooses, and no one has the right to cavil or object.

This is true only when such a gift does not wrong another. There are circumstances when a person has this undoubted right, but such can only exist when the person so benefited would not have gone to another for the labor involved. If, on the contrary, such work is done in a spirit of competition, advertisement, or to prevent another from being properly remunerated, it ceases to be generosity, becomes contemptible, and degrades not only the doer but the entire profession.

One more example from my experience, and I will leave this field of sorrow and heartburnings. An architect is employed, receives instructions, makes and presents his sketches, which are pronounced satisfactory. Shortly after he is informed by his client that several reputable architects have volunteered to do the work for one-half commission, and unless he complies the work will be given to another. He declines, asks to be relieved, paid the regular commission for the sketches furnished, and is refused. The work is given to one of the parties referred to, who knows of the existing circumstances, and probably did so when he made the first offer. The retiring architect is compelled to sue in a court of law for his earned commission; the architect supplanting him, as above indicated, and also a member of the Institute, appears as a witness against him, and testifies that although one per cent is the usual and customary compensation for the work done, he considers it an excessive and extravagant charge, and he would feel perfectly satisfied with one-half of that amount. And although three other architects testified in the case to the correctness of the charge, the judges decided, on the testimony above cited, against the suitor's claim, and allowed him only one-half.

Can one feel surprised or aggrieved under circumstances and experiences like these, that the vast majority of the public attach no value to the services of an architect? That they are looked upon as extortioners? nay, almost as a species of legalized robbers, whom it is dangerous to approach? If we wish to exact respect from the public, we must respect ourselves, and if we wish them to believe our services are of value, we ourselves must first value them; otherwise we indeed labor in vain, nor need feel astonished at treatment as startling as occurred only a few days since, and which illustrates a sad chapter on competitions, that architectural "Pandora's box," without some allusion to which this paper could scarce pass current as complete.

A distinguished prelate of an influential church, especially noted for his fine sense of honor and integrity, invites a number of architects to submit plans for a large educational establishment about to be founded. Somewhere about a dozen respond, and after due deliberation, three of the submitted designs are chosen, and respectively rewarded by the first, second and third premiums. The conditions stipulated in the invitation were that the recipient of the first premium should make the requisite drawings for the work on a commission of two and one-half per cent, the amount of the premium received to be deducted from the commission named. The successful competitor acknowledges the receipt of the premium with natural satisfaction, and intimates that he is ready to go on with his work, and the more time allowed him, the more satisfactory could he make his labor. To this acknowledgment he never even received a reply, and about three weeks since, the work was awarded and accepted by a member of this Institute, conversant with every circumstance of the competition, who had never drawn a line, or, possibly, given it a moment's thought.

What I have given you in this paper is the result of personal knowledge, and in most instances, as you will probably conjecture, of unpleasant experience, nor are my thoughts far wrong when I imagine it will tally with that of a majority of this Institute, as well as others.

And now, Gentlemen and Brothers in the Art Creative, does it not strike you that there is something wrong somewhere, and the sooner we remedy it, the better it will be for all of us? If we have a code of ethics and they are sufficient, they surely want to cease being a dead letter, or, if not suited to the wants of to-day, a regeneration that will fit them to the demands. If our schedule of charges is unfair and exorbitant for the labor we perform, let us lessen it; if proper, let us enforce it. Let the Institute and its, nay, our representatives say what is proper, and, after saying it, not let their words die on the air, but give them life and force, by demanding either strict compliance or severance. Let not the Institute become an idle name, and, in being a name only, deserve the contempt it is sure to earn, both from the public and its members; not the less true because it may be not expressed, but because felt by all who strive well and honestly.

Let the edict go forth:—

No more competitions without the sanction of the Institute, and in accordance with its rules and regulations.

No more offering or agreeing to make plans or drawings free of charge, to be paid for if adopted.

No more sealing of prices for the sake of securing work.

But let every member work and give his best efforts to maintain the honor and integrity of the Institute, and thereby he will surely advance and sustain his own. In doing this he will make his coworkers respect and esteem him, as he will learn to regard them, and not, as is too often the case now, feel and look upon nearly every one who happens to be located near you as a bird of prey, watching your every movement to capture your spoils.

I am not picturing to myself, nor asking your assistance to found an architectural Utopia. I am fully convinced that no two persons probably ever existed, whose ideas of right and wrong were precisely or identically the same; there must and will be some, the epidermis of whose conscience is of thicker texture than that of others. It is not finicky honesty, but manly integrity we want, an intention to do right unselfishly, not for our own benefit, but for the good and welfare of all; this all can give, be it in their own way, so their purpose be but true.

Let our officers, those selected and designated to watch over our welfare and the prosperity of our art — let them, I say, do their duty fearlessly and without favor; let their justice be swift and sure, ever on the alert, ever ready to act and perfect the trust confided to their keeping. Then, indeed, will every member striving to do what is right feel that he has some support, some assistance; then, in fact, will our Association, our Institute become a palladium to the honest, and cease to be a bulwark to the unscrupulous.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

STAIRCASE-HALL IN THE HOUSE OF A. A. CARY, ESQ., CAMBRIDGE, MASS. MESSRS. STURGIS & BRIGHAM, ARCHITECTS, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial Edition.]

BUILDING FOR THE URSULIN SISTERS, TIFFIN, O. MESSRS. E. O. FALLIS & CO., ARCHITECTS, TOLEDO, O.

THE building is to be used as a convent and school for the Ursulin Sisters; the right wing being occupied as chapel, the left as school-rooms; the centre portion, with intersecting wings, as convent. The first story of this part is to be built of stone; the other portions of brick, stone trimmings and terra-cotta.

CAPE COD SKETCHES, NO. I.

HOUSE OF W. H. HOWARD, ESQ., SAN MATEO, CAL. MR. BRUCE PRICE, ARCHITECT, NEW YORK, N. Y.

HALL MANTEL IN THE SAME.

SAFE BUILDING.[1]—XI.

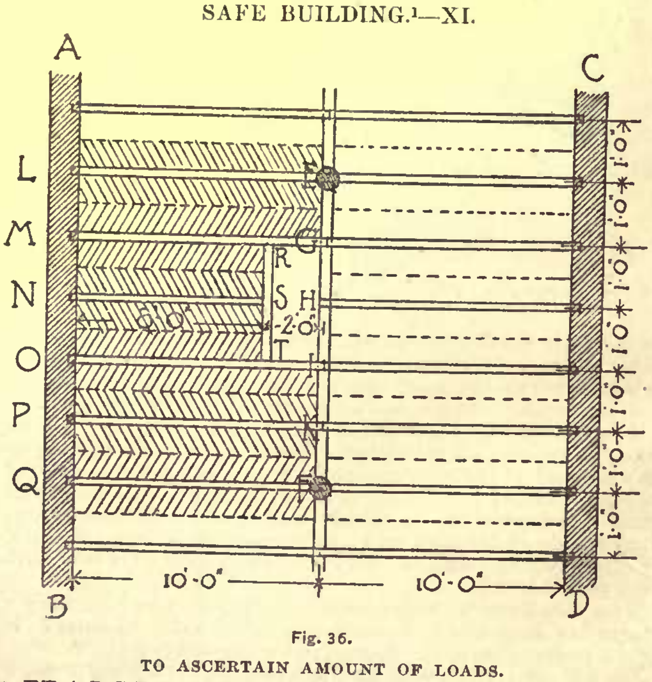


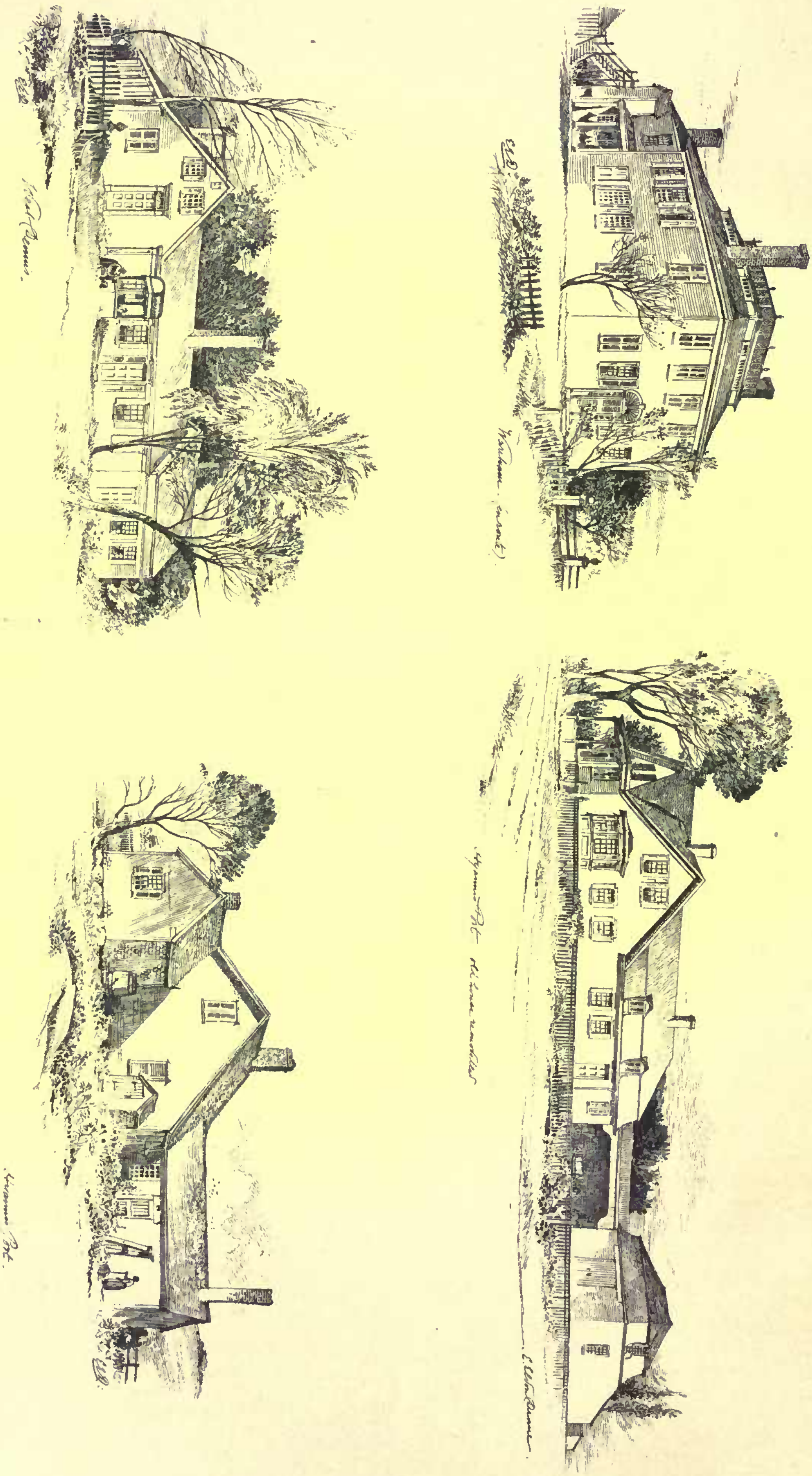
Fig. 36.

TO ASCERTAIN AMOUNT OF LOADS.

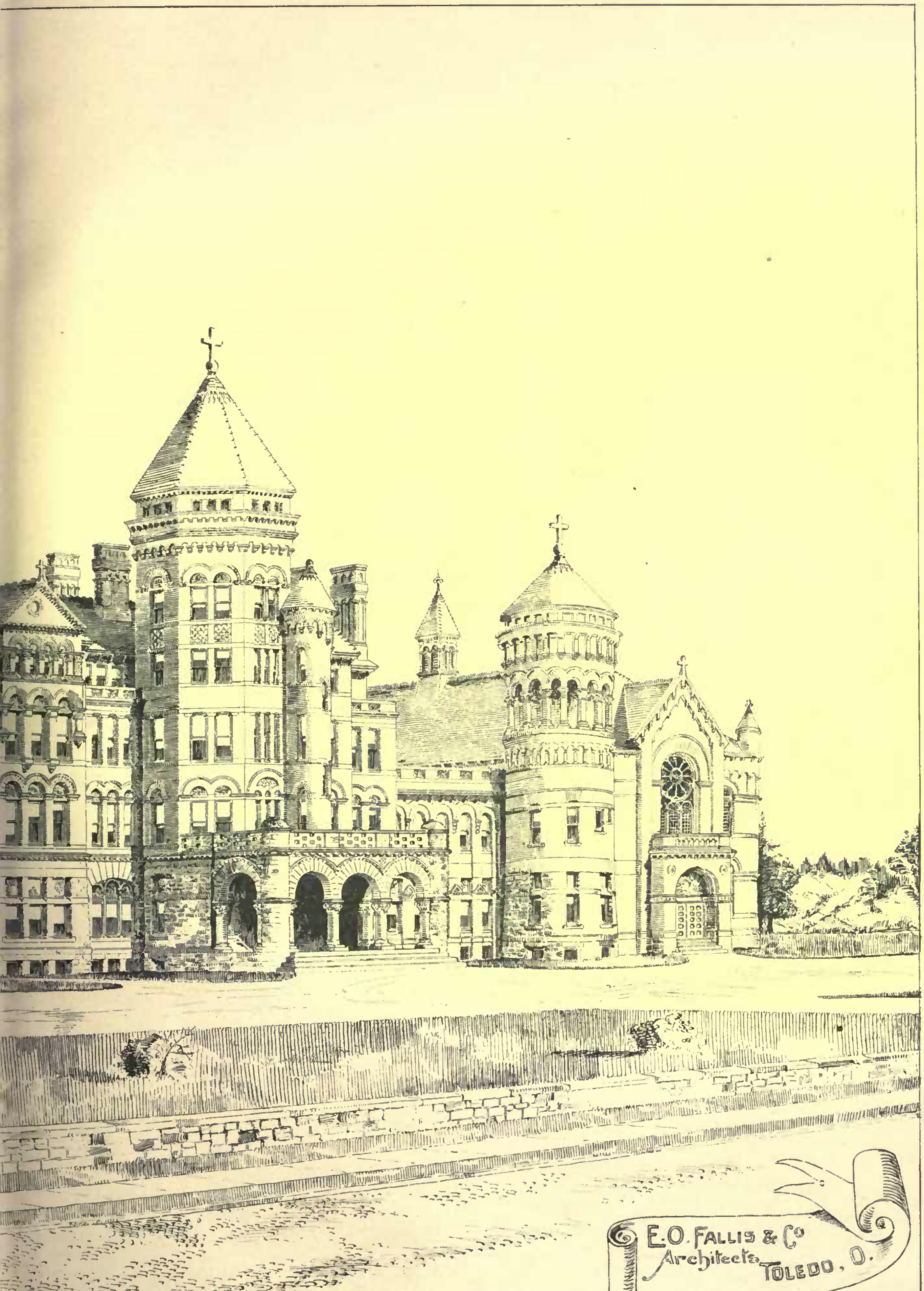
LET A B C D be a floor plan of a building, A B and C D are the walls, E and F the columns, with a girder between, the other lines being floor beams, all 12" between centres; on the left side a well-hole is framed 2' x 2'. Let the load assumed be 100 pounds per square foot of floor, which covers the weight of construction.

[1] Continued from page 269, No. 571.

Cape Cod Sketches. No. 1.

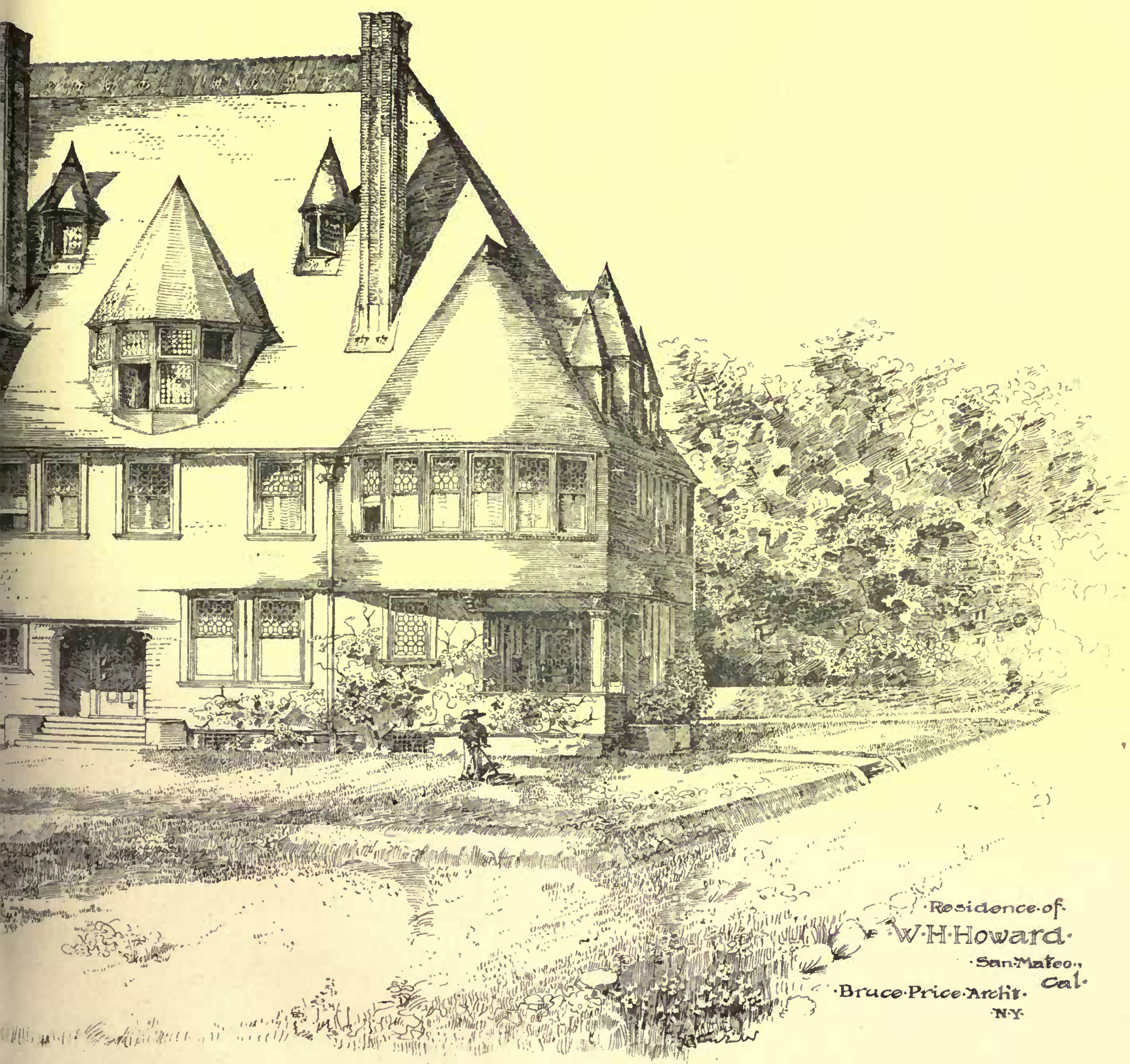



COLLEGE of
URSULIN SISTERS
TIFFIN OHIO.
WM COWE. DEL



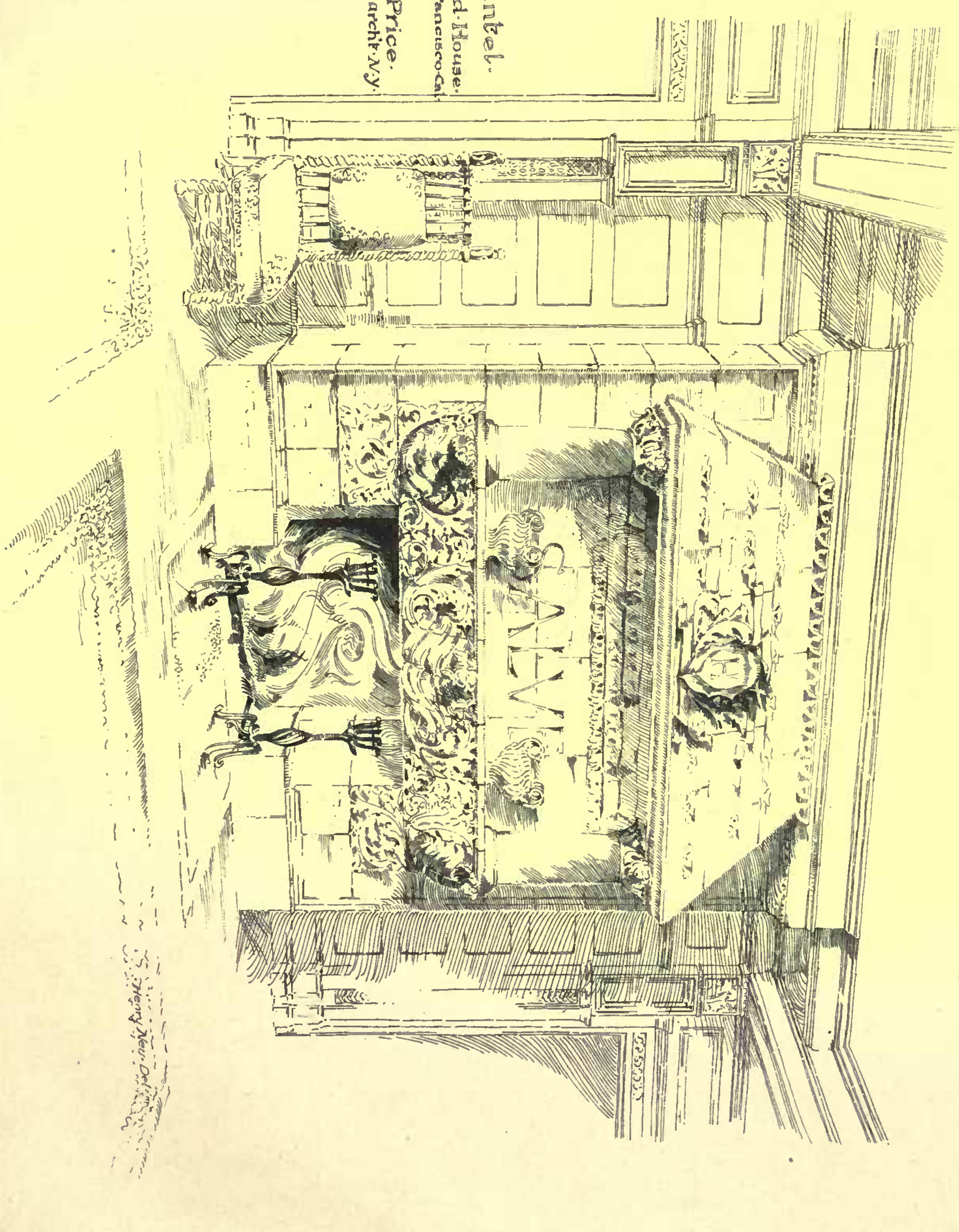
Heliotype Printing Co. Boston.


Henry Neu Del.



Heliotype Printing Co. Boston.

·Hall·Mantel·
·W·H·Howard·House·
·San Francisco·Cal·
·Bruce·Price·
·archt·N.Y.



Heliotype Printing Co Boston

Load on Beams. Each of the right-hand beams, also the three left-hand beams E L, K P and F Q will each carry, of course, ten square feet of floor, or

10.100 = 1000 pounds each uniform load. Each will transfer one-half of this load to the girder and the other half to the wall. The tail beam S N will carry 8 square feet of floor, or

8.100 = 800 pounds uniform load. One-half of this load will be transferred to the wall, the other half to the header R T, which will therefore carry a load of 400 pounds at its centre, one-half of which will be transferred to each trimmer.

The trimmer beam G M carries a uniform load, one-half foot wide, its entire length, or fifty pounds a foot (on the off-side from well-hole), or

50.10 = 500 pounds uniform load, one-half of which is transferred to the girder and the other half to the wall. The trimmer also carries a similar load of fifty pounds a foot on the well-hole side, but only between M and R, which is eight feet long, or

50.8 = 400 pounds, the centre of this load is located, of course, half way between M and R, or four feet from support M, and six feet from support G, therefore M will carry (react)

$$\frac{6.400}{10} = 240 \text{ pounds and G will carry}$$

$$\frac{4.400}{10} = 160 \text{ pounds.}$$

See Formulæ (14) and (15).

We also have a load of 200 pounds at R, transferred from the header on to the trimmer; as R is two feet from G, and eight feet from M, we will find by the same formulæ, that G carries

$$\frac{8.200}{10} = 160 \text{ pounds and M carries}$$

$$\frac{2.200}{10} = 40 \text{ pounds.}$$

So that we find the loads which the trimmer transfers to G and M, as follows:

At M = 250 + 240 + 40 = 530 pounds.
" G = 250 + 160 + 160 = 570 pounds.

The loads which trimmer O I transfers to wall and girder will, of course, be similar. We therefore find the total loading, as follows:

Load on Walls.

On the wall A B:

At L =	500 pounds.
" M =	530 pounds.
" N =	400 pounds.
" O =	530 pounds.
" P =	500 pounds.
" Q =	500 pounds.
Total on wall A B =	2960 pounds.

Load on Girder. On the wall C D we have six equal loads of 500 pounds each, a total of 3,000 pounds.

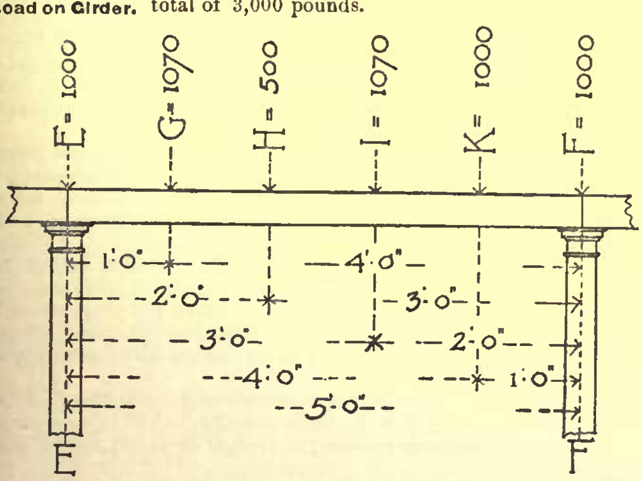


Fig. 37.

On the girder E F, we have:

At E from the left side 500 pounds, from the right 500 pounds. Total 1000 pounds.
At G from the left side 570 pounds, from the right 500 pounds. Total 1070 pounds.
At H from the left side nothing, from the right 500 pounds. Total 500 pounds.
At I from the left side 570 pounds, from the right 500 pounds. Total 1070 pounds.
At K from the left side 500 pounds, from the right 500 pounds. Total 1000 pounds.
At F from the left side 500 pounds, from the right 500 pounds. Total 1000 pounds.
Total on girder 5640 pounds.

As the girder is neither uniformly nor symmetrically loaded, we must calculate by Formulæ (16) and (17), the amount of each reaction, which will, of course, give the load coming on the columns E and F. (These columns will, of course carry additional loads, from the girders on opposite side, further, the weight of the column should be added, also whatever load comes on the column at floor above.)

Girder E F then transfers to columns,

At $E = 1000 + (\frac{4}{5}.\ 1070) + (\frac{3}{5}.\ 500) + (\frac{2}{5}.1070) + (\frac{1}{5}.\ 1000) + (0.\ 1000) = 2784$ pounds.

At $F = 1000 + (\frac{4}{5}.\ 1000) + (\frac{3}{5}.\ 1070) + (\frac{2}{5}.\ 500) + (\frac{1}{5}.\ 1070) + (0.\ 1000) = 2856$ pounds.

As a check the loads at E and F must equal the whole load on the girder, and we have, in effect,

$$2784 + 2856 = 5640.$$

Now as a check on the whole calculation the load on the two columns and two walls should equal the whole load. The whole load being 20′ x 6′ x 100 pounds minus the well-hole 2′ x 2′ x 100 pounds, or 12000 — 400 = 11600 pounds.

And we have in effect,

Load on A B	= 2960 pounds.
" C D	= 3000 pounds.
" two columns	= 5640 pounds.
Total loads	= 11600 pounds.

We therefore can calculate the strength of all the beams, headers and trimmers and girders, with loads on, as above given.

For the columns and walls, we must however add, the weight of walls and columns above, including all the loads coming on walls and columns above the point we are calculating for, also whatever load comes on the columns from the other sides. If there are openings

Load over Wall Openings. in a wall, one-half the load over each opening goes to the pier each side of the opening, including, of course, all loads on the wall above the opening.

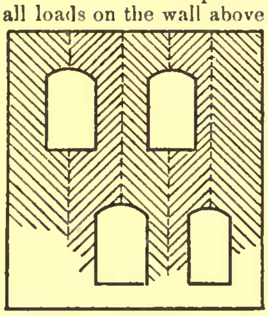


Fig. 38.

Thus in Figure 38, the weight of walls would be distributed, as indicated by etched lines; where, however, the opening in the wall is very small compared to the mass of wall-space over, it would, of course, be absurd to consider all this load as on the arch, and practically, after the mortar has set, it would not be, but only an amount about equal to the part enclosed by dotted lines in Figure 39, the inclined lines being at an angle of 60° with the horizon. Where only part of the wall is calculated to be carried on the opening, the wooden centre should be left in until the mortar of the entire wall has set. In case of beams or lintels the wall should be built up until the intended amount of load is on them, leaving them free underneath; after the intended load is on them, they should be shored up, until the rest of wall is built and thoroughly set.

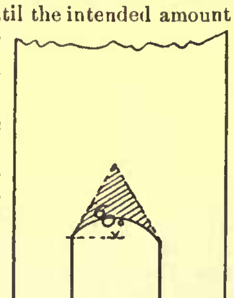


Fig. 39.

Wind Pressure and Snow. Wind-pressure on a roof is generally assumed at a certain load per square foot superficial measurement of roof, and added to the actual (dead) weight of roof; except in large roofs, or where one foot of truss rests on rollers, when it is important to assume the wind as a separate force, acting at right angles to incline of rafter.

The load of snow on roofs is generally omitted, when wind is allowed for, as, if the roof is very steep snow will not remain on it, while the wind pressure will be very severe; while, if the roof is

GLOSSARY OF SYMBOLS.—The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.:—

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_1 = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
$\mathfrak{d}$ = *diameter*, in inches.
$\mathfrak{r}$ = *radius*, in inches.
π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{I}, a_{II}, a_{III}, etc., or b, b_{I}, b_{II}, b_{III}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance:—

m = moment or bending moment at *centre*.
m_A = " " " *point A*.
m_B = " " " *point B*.
m_X = " " " *point X*.
s = strain at *centre*.
s_B = " *point B*.
s_X = " *point X*.
v = stress at *centre*.
v_D = " *point D*.
v_X = " *point X*.
w = load at *centre*.
w_A = " *point A*.

flat there will be no wind pressure, the allowance for which will, of course, offset the load of snow.

If the roof should not be steep enough for snow to slide off, a heavy wind would probably blow the snow off.

In case of "continuous girders," that is, beams or girders supported at three or more points and passing over the intermediate supports without being broken, it is usual to allow more load on the central supports, than the formulæ (14) to (17) would give. This subject will be more fully dealt with in the chapter on beams and girders.

FATIGUE.

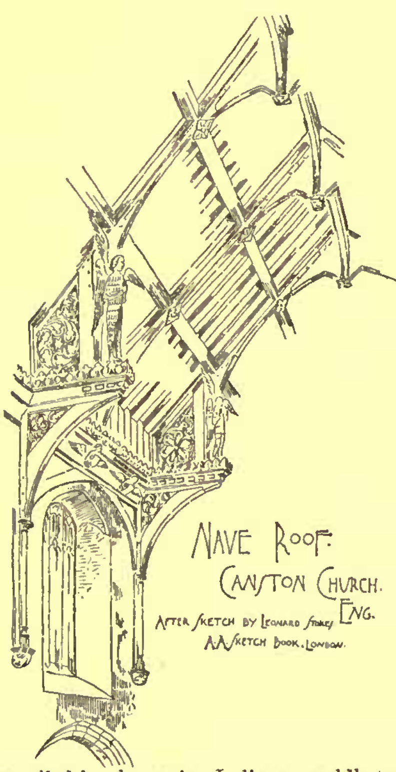
If a load or strain is applied to a material and then removed, the material is supposed to recover its first condition (provided it has not been strained beyond the limit of elasticity). This practically, however, is not the case, and it is found that a small load or strain often applied and removed will do more damage (fatigue the material more) than a larger one left on steadily. Most loads in buildings are stationary or "dead" loads. But where there are "moving loads, such as people moving, dancing, marching, etc., or machinery vibrating, goods being carted and dumped, etc., it is usual to assume larger loads than will ever be imposed; sometimes going so far as to double the actual intended load, or what amounts to the same thing, doubling (or increasing) the factor-of-safety, in that case retaining, of course, the actual intended load in the calculations. This is a matter in which the architect must exercise his judgment in each individual case.

Moving Loads.

Louis DeCoppet Berg.

[To be continued.]

THE TULIP-TREE, WHITEWOOD, AMERICAN OR YELLOW POPLAR.



THIS is the *Liriodendron tulipifera* of Linnæus, the tulip-bearing liriodendron, tulip-tree, saddle-tree, or tulip-bearing lily-tree of the arboriculturists, which produces the wood known in commerce by the varient name of poplar, Virginian poplar, white poplar, yellow poplar, whitewood, canary whitewood, canary-wood, or canoe-wood. The French *Tulipier de Virginie* and the German *Virginischer Tulipeerbaum* are literal translations of the word Virginian tulip-tree.

This tree is called *Liriodendron*, from *leirion*, a lily, and *dendron*, a tree, from the flowers resembling those of a lily, though more correctly those of a tulip, as the specific name implies. It is called poplar from its general resemblance to trees of that genus; whitewood, and canary-wood, from the white or yellow color of the wood, the wood varying in color when grown under different circumstances; canoe-wood, from the use to which it is applied by the native Indians; saddle-tree, from the cut or scalloped form of the leaves bearing some resemblance to a saddle. There is only one species of this tree, and it is of the first rank. The flowers are yellowish, variegated with green, red, and orange; the corolla is composed of six petals, and it assumes a tulip or bell-shaped form.

The tree has no relation to the poplar; it represents one of three genera, composing the order *Magnoliacæ*, the genus Magnolia being considered the type of this order.

The tulip-tree is a native of North America. It abounds in the Middle States, in the upper parts of the Carolinas and of Georgia, and is found still more abundantly in the western country, particularly in Kentucky. Its comparative rareness in the maritime parts of the Carolinas, and of Georgia, in the Floridas, and in lower Louisiana is owing less to the heat of summer than to the nature of the soil which, in some parts, is too dry, as in the pine barrens, and in others too wet, as in the swamps which border the rivers. Even in the Middle and Western States the tulip-tree is less abundant than the oaks, the walnuts, the ashes, and the beeches, because it delights only in deep, loamy, and extremely fertile soils, such as are found in the rich bottoms that lie along the rivers, and on the borders of the great swamps that are enclosed in the forests.

In the Atlantic States, especially at a considerable distance from the sea, tulip-trees are often seen seventy feet, eighty feet, and one hundred feet in height, with trunks from eighteen inches to three feet in diameter; but the Western States seem to be the natural soil of this magnificent tree, and there it displays its most powerful vegetation. It is commonly found mingled with other trees, such as the hickories, the black walnut and butternut, the Kentucky coffee-tree, and the wild cherry-tree; but it sometimes constitutes, alone, pretty large tracts of the forest, as on the road from Beardstone to Louisville. In no other part of the United States is the tulip-tree so lofty and of so great a diameter.

The southern extremity of Lake Champlain, in latitude forty-five degrees, may be considered its northern limit, and the Connecticut River, in the longitude of seventy-two degrees, as its eastern limit. Its expansion is repressed in Vermont, and in the upper part of the continent, by the excessive cold, and by a mountainous surface unfavorable to its growth.

This tree has what is termed an artificial geography, which may be said to embrace the middle region of Europe, from Berlin and Warsaw, on the north, to the shores of the Mediterranean and Naples, on the south, Ireland on the west, and the Crimea on the east. Although not much known as an introduced tree in Great Britain, it has gained a remarkable footing in Central Europe. The first notice we have of the tulip-tree on the Continent is in the "*Catalogue of the Leyden Garden*," published in 1731. From the number of trees existing in France, the south of Germany, and Italy, there can be little doubt that it spread rapidly in those countries. Public avenues are planted with it in Italy, and as far north as Strasburg and Metz. It stands the open air and attains a large size in Vienna.

The uses of the tulip-tree in Europe are limited almost entirely to those of ornament; for though there are numerous trees which would produce excellent timber if cut down, we have never heard of any having been felled for this purpose, or, indeed, for any other. Every possessor of a tulip-tree in Europe values it far higher for its beauty in a living state than for its products.

Considering the rapid growth of the tree, and the valuable character of the wood, it is somewhat strange that it is not propagated for its timber, to the displacement of other and less valued trees. Loudon informs us that he saw at Syon, in the environs of London, a tree which in about seventy years attained a height of seventy-six feet, the trunk at one foot from the ground being two feet six inches in diameter; another at Mount Grove, Hampstead, eighty years planted, was seventy feet high, with a diameter of trunk three feet ten inches; another in the arboretum at Kew, sixty years planted, was seventy feet high, with a diameter of the trunk of two feet eight inches; a tree at Kinlet, Worcestershire, fifty years planted, sixty feet high and two feet seven inches diameter of trunk; at Croome, in the same county, seventy years planted, seventy-five feet high, and two feet six inches diameter of trunk; at Hopetoun House, Scotland, eighty-six years planted, sixty feet high, and two feet four inches diameter of trunk; at Tyningham, seventy-two years planted, thirty-four feet high, and two feet three inches diameter of trunk. Other statistics could be given in Ireland, France, Prussia, Austria, etc., which would prove that it thrives in its adopted home of Europe.

This tree, in its native woods, is often seen from seventy to one hundred feet in height, with a trunk the diameter of which varies from eighteen inches to three feet. Instances are recorded of their being found fifteen feet or sixteen feet in circumference, one near Louisville being twenty-two feet six inches in circumference at five feet from the ground, the height of the tree being from one hundred and twenty to one hundred and forty feet.

Of all the deciduous trees of North America, the tulip-tree, next to the button-wood, attains the amplest dimensions; while the perfect straightness and uniform diameter of its trunk for upwards of forty feet entitle it to be considered one of the most magnificent trees of the temperate zones.

The bark, till the trunk exceeds seven inches or eight inches in diameter, is smooth and even; it afterwards begins to crack, and the depth of the furrow and the thickness of the bark are proportioned to the size and to the age of the tree. The heart or perfect wood of the tulip-tree is yellow, approaching to the lemon color, and its sap or alburnum is white.

In Europe, though not attaining the same magnitude that it does in situations favorable to it in its native country, it still forms a magnificent tree, in some cases reaching the height of ninety feet or one hundred feet.

The timber, though classed among light woods, is much heavier than that of the common poplar; its grain is equally fine, but more compact, and the wood is easily wrought and polished. It is found strong and stiff enough for uses that require great solidity.

The heartwood, when separated from the sap and perfectly seasoned, long resists the influence of the air, and is said to be rarely attacked by insects. Its greatest defect, when employed in wide boards and exposed to the weather, is that it is liable to shrink and warp by the alternations of dryness and moisture; but this defect is in a great measure compensated for by its other properties, and may be, in part, owing to its not being allowed sufficient time to be properly seasoned.

The nature of the soil has so striking an influence upon the color, and upon the quality of the wood, that the consumers distinguish it by the names of the white poplar and the yellow poplar. The trees show no outward signs of the special character of the wood they contain, and it is only made manifest by cutting it. The white variety is looked upon as inferior, the yellow being used for all the better purposes.

At New York and Philadelphia, and in the adjacent country, it is often employed in the construction of houses for rafters, and for the

joists of upper stories. In the other Middle States and in the Western States, it is more generally used in building, and is considered as the best substitute for the pine, the red cedar and the cypress. Wherever it abounds, it serves for the interior work of houses, and sometimes for the exterior covering, the panels of doors and of wainscots, and the mouldings of chimney-pieces.

Shingles about fifteen inches long, are made of this tulip wood; for this purpose the wood is very suitable, as it is found to be proof against splitting by extreme heat or frost.

In all the large towns of the United States tulip or poplar boards are used in widths of two feet to three feet. When dry, it takes the paint or polish remarkably well. The seats of the American Windsor chairs are invariably made of this wood. It is also used for trunk and box-making, for furniture, agricultural implements, turnery, broom heads, etc. The farmers use it for troughs, which are hewn from the solid log. The Indians who inhabited the Middle States, and those who still remain in the Western country, prefer this tree for their canoes, which, consisting of a single trunk, are very light and strong, and sometimes carry twenty persons.

In the lumber yards of New York, Philadelphia and Baltimore a great quantity of this wood is found in converted sizes, and compared with black walnut, curly birch, etc., it is sold very cheap.

In the country watered by the River Monongahela, between thirty degrees and forty degrees of latitude, the tulip tree is so abundant that large rafts composed wholly of its logs are made to float down the stream.

Of late years a growing trade has been done in England in what is called American whitewood, or canary whitewood, for in the field of commerce we do not hear of it as tulipwood. This adoption of a popular trade name, merely descriptive of the wood itself, offers a real difficulty where the botanical name or character of the tree producing it is required. The writer, who is well acquainted with the imported wood, made inquiries amongst the Liverpool merchants, with the result that it was considered the produce of an American poplar, a statement negatived by the curator of museums at Kew, and the botanical secretary attached to the Canadian section of the Indian and Colonial Exhibition, London, who class it as tulip wood.

The imported wood reaches this country, principally from New York, in waney logs, prepared after the manner of Quebec waney pine, associated with sawn planks of very fine dimensions.

The wood is remarkably clean and sound, and in the case of planks, they are mostly cut clear of heart or fault, in which state they command a price fully equal to that of first quality Quebec yellow pine. The yellow or lemon-colored wood is the best, and it is only occasionally that the white variety, or real poplar is shipped.

The uses to which this fine wood is applied are legion, and it is rapidly becoming a factor in the wood trade of this country.

It is freely used by the cabinet-maker, the shop-fitter, and the builder or house-fitter, the easy manner in which it is wrought or worked, its firm character when fully dried, and its suitability for staining or polishing rendering it a special favorite.

It is a favorite wood with coach and carriage builders, who have not been slow to discover its merits, and it is highly spoken of by agricultural implement makers and other consumers of wood. — *The Timber Trades Journal.*

ON THE PURIFICATION OF WATER BY AGITATION WITH IRON AND BY SAND FILTRATION.[1]



THE fact that iron possesses the property of removing from impure waters coloring matter and organic contamination has been known for these thirty years. In 1857 Dr. Medlock took out a patent, according to which water was to be purified by suspending iron in the tanks containing it; but no practical results followed till some eighteen years ago, when Prof. G. Bischof took the matter up, and contrived the domestic filter, which now enjoys a deservedly high reputation. In these filters the water, after a rough preliminary filtration, passes through a layer of iron in a coarsely granular condition, then through a stratum of native peroxide of manganese, and finally through a layer of filtering sand.

In applying iron to the purification of water upon a large scale, Professor Bischof adopts a different arrangement. The water first passes through a layer of ordinary filter sand, by which the mechanical impurities are separated, then through a layer composed of a mixture of three parts, by measure, of coarse gravel to one part of the granular iron, and, finally, the water is made to flow through an ordinary sand filter. In the layer of gravel and iron a chemical reaction takes place. The iron is slowly dissolved by the water through the combined agency of the free oxygen and carbonic acid which are always present, in variable quantities, in natural waters; the carbonate of iron and low hydrated oxides of the metal which are formed afterwards pass into a higher state of oxidation at the expense of the free oxygen in the water, or of that taken up from the air after the passage of the water through the iron and gravel mixture. I will not attempt to determine the precise nature of the purifying action, but the fact remains that iron is first dissolved in the water to the extent of about one-tenth of a grain to the gallon, and that, during this process and the subsequent deposition, a powerful effect is produced on organic matters held in solution.

Professor Bischof's system was for some time in operation on a large scale at the Antwerp water-works, and left nothing to be desired so far as the cleansing effect on the water was concerned. But the River Nethe, from which the supply is taken, is a greatly polluted stream; the iron, therefore, had an abnormal amount of work to do, and, in consequence, the upper layers of the iron and gravel mixture got choked comparatively quickly with the dissolved impurities separated from the water.

It was curious to note the appearance of the iron filters. All that could be seen from above, when the water had been drawn off, was the ordinary surface of a sand filter, which had to be cleaned in the usual way about every fortnight. On digging through the sand no change could be detected till the spade arrived within a couple of inches of the iron mixture, when discoloration became apparent, and this continued to increase till the layer of iron was reached. For six or eight inches the gravel and iron particles were thickly coated and mixed with a reddish, slimy substance, the product of the chemical action of the iron. Deeper down the mixture was of an intense black, and had apparently remained unchanged during the four years that the filters had worked. The upper six inches of the iron mixture had to be removed and washed about every six months, but no difficulty was experienced from any concreting together of the mass. There is very little doubt but that, with purer water, the inconvenience and expense caused by the great deposition of slimy matter would have been less severely felt, and I believe that, in the case of domestic supplies and moderate-sized installations, Professor Bischof's system is the best yet introduced. The behavior of the filters at Antwerp demonstrates conclusively that a true chemical action takes place, because the water, before it reached the iron, had undergone twelve hours' subsidence and ordinary filtration through two feet deep of sand, and must, therefore, have been deprived of all the mechanical suspended impurities which sand was capable of taking from it; and yet, the remaining impurities, when acted on by the iron, were sufficient to cause the clogging up of a very open mixture of gravel and iron, much too coarse to act as a filter, and which, as a matter of fact, permitted the water to issue on to the sand filters in the muddy condition which it must have acquired in passing through.

The rate of filtration was not nearly so rapid as it was expected from preliminary experiments. It was thought that the water could be purified at the rate of one hundred and fifty gallons per square foot per twenty-four hours. In reality, however, the rate did not exceed half that amount. For small installations and with fairly clean water it would be safe, I think, to make the iron and sand filters each have an area of such extent as to filter at the rate of eighty gallons per square foot per twenty-four hours.

The water, as it comes from the iron filters, should be allowed to fall in a shallow cascade or a balloon-jet into the sand filter, so as to bring as large a surface as possible into contact with the air; with some kinds of water it is very difficult to remove a faint marshy taste and smell; in such cases, the blowing of a considerable volume of air through the water after treatment with iron, by means of perforated pipes, has been found beneficial, and the same method is efficacious in hastening the deposit of iron where there is not sufficient space to allow time for natural aeration. The depth over the sand should be such as to allow about four hours before the inflowing water reaches the sand. Thus, if the filtration be at the rate of six inches deep per hour, or seventy-four and one-half gallons per square foot per twenty-four hours, the water over the sand should not be less than two feet deep. Over the filters the water assumes a reddish hue, and a slimy deposit is left on the surface of the sand; this has to be removed from time to time in the usual manner, the frequency depending on the purity of the water to be treated, and generally, also, on the season of the year. When a filter begins to run sluggishly, its life may be increased by about twenty-five per cent by trailing a light chain over the surface of the sand, and by that means breaking up the slimy deposit.

After four years' working the demand for water by the city of Antwerp had increased to an extent which rendered it imperative that the means of purification should be extended. To double the existing arrangements would have involved the employment of nine hundred tons more iron and an extension of space which would have led to immense expenditure. Under these circumstances I determined to try a suggestion first made to me by Sir Frederick Abel, of treating the water by agitation with iron instead of by filtration through it. Sir Frederick had pointed out that the action of the iron was of a chemical nature, and that it was desirable to present it continually to the water in the cleanest condition possible, and at the same time to cause the clean metal surfaces to come into contact with fresh quantities of the water under treatment; and that these conditions could

[1] A paper by W. Anderson, M.I.C.E., read before the Society of Arts, November 24, and published in the *Journal* of the Society.

be best secured by causing the iron particles to tumble about in a cylinder through which the water was caused to flow very slowly. The difficulty in the way of adopting Sir Frederick Abel's suggestion arose from the idea which prevailed, though not with him, that very prolonged contact, as much as three-quarters of an hour, between the water and the iron was indispensable; hence the scheme seemed almost impracticable for large volumes of water. Notwithstanding this prejudice, however, an experimental revolving cylinder was at last made, and it was very soon proved that even the impure waters of the Nethe could be perfectly dealt with by agitation with clean iron, with a contact of three and one-half minutes only. In working out this process I have been greatly indebted to Mr. G. H. Ogston, who had been associated with me from the first, who had made all the analyses, and who had previously tested and condemned many other plans for obtaining the object in view. The "revolver," as the purifying apparatus is called, consists of an iron cylinder arranged to revolve on its long axis on hollow trunnions secured to each end. The trunnions are fitted with pipes, connected to them by means of ordinary stuffing-boxes and glands, so that the pipes remain stationary while the trunnions revolve water-tight around them. The trunnions are supported on ordinary pedestals, and a slow rotatory motion is given to the cylinder by means of a spur ring secured round one end, and driven by a pinion actuated by a suitable train of wheel work. The inlet pipe opens into the cylinder against a disc which forces the water to spread evenly in a radial direction, and the outlet pipe commences in the cylinder in the form of an inverted funnel, up which the water streams so slowly that none but the finest particles of iron are carried away. The inside of the revolver is fitted with curved shelves or ledges arranged in sets to hit and miss each other; these serve to scoop up the iron and shower it down again almost continuously through the water. One-tenth of the volume of the cylinder is filled with coarsely-subdivided iron, either Professor Bischof's granular, so-called, spongy material, or iron cast into small bullets, or iron granulated by being poured into water, or by ordinary coarse, cast-iron turnings or borings from engineer's shops. The last form of iron is found, so far, to be the most efficient. The motion of the cylinder is very slow. The Antwerp revolvers, which are five feet diameter and fifteen feet long, with ten-inch inlet and outlet pipes, capable of purifying five hundred gallons per minute, revolve once a minute, and require about one-third horsepower to drive them.

In March, 1885, three of these revolvers were started at Antwerp, and the original iron and gravel beds were converted into ordinary sand filters; by this change the capacity of the works was at once doubled. The total weight of iron in use at one time was reduced from nine hundred tons to three-and-a-half tons, and all the expenses connected with digging over and washing the purifying materials were done away with.

When pure water is passed through a revolver, a certain amount of iron is dissolved, and then the water flows out a light gray color. After two or three hours the color changes to a reddish brown, and a deposit of rust takes place at the bottom of the vessel. If filtered at once, on escaping from the revolver, the liquid will generally be clear at first, but after a time it will sometimes get cloudy and the deposit of rust will take place, showing that the iron existed in the first instance in solution, and was afterwards precipitated by the action of atmospheric oxygen. If the water be impure, colored and charged with dissolved organic matter, it will issue from the revolver of a dark gray color, and this will increase to an inky black in the case of very bad water, so that it is possible to judge of the quality of the water by the color assumed during its treatment. If the impurities are not more than the iron can deal with, the liquid, on standing for some three or four hours, becomes lighter and lighter in color, a black precipitate forms and sinks very slowly to the bottom, the color becomes a dirty gray, and then the water will filter quite clear and bright. If the impurities overpower the iron, or are of a nature which the iron cannot effectually attack, a purplish color remains, and the liquid will not filter colorless. As in the case of the Bischof filter, the time of repose and exposure to the air before filtration is obtained by providing a sufficient depth of water over the sand of the filter beds.

In addition to its chemical action, iron possesses the property of causing the very finely-divided particles of matter, which cause opalescence and cloudiness, to coagulate to such an extent that they can be removed by filtration. The waters of the Nile, for example, which will not subside clear in any reasonable time, and which cannot be filtered bright by sand filters, yield a beautifully clear water if agitated with iron before filtration through sand.

From the nature of the case, the system described is absolutely permanent and constant in its action. The surfaces of the particles of iron are necessarily preserved bright and effective, and the slow waste being made good by periodic additions of fresh iron, the revolver once set to work, will go on acting in the same manner for an indefinite time.

In a recent paper, read before the Institution of Civil Engineers, Dr. Percy Frankland[1] described certain results which he had obtained by agitation of water with various finely-divided solid substances, including the so-called spongy iron of Professor Bischof, and his results led him to the conclusion that the simple process of agitation could accomplish "a most remarkable purification," but that its efficiency "cannot at present be relied upon, owing to the uncertainty of its success."

This conclusion may be correct with respect to such materials as chalk, charcoal and coke, with which Dr. Frankland experimented, and which might have the effect of removing organized matter "by mere contact, to which he appears mainly to ascribe the results obtained by him, and the uncertain success of the treatment. But it is impossible to understand how the classification of finely-divided iron with these materials, "in regard to the dependence of its efficiency upon mere contact, and therefore, to the uncertainty of success of an agitating process in which finely-divided iron is the agent used," can be reconciled by the author with his statement of results obtained by him in the employment of iron as a filtering agent. Dr. Percy Frankland justly considered it of great interest to ascertain the character of the purifying results obtained by Clark's process upon the large scale. It is therefore to be regretted that he did not also examine into results which the treatment — by agitation of water with finely-divided iron — were furnishing upon a large scale, and thus eliminate the uncertain, and the consequently fallacious nature of the results of his small-scale laboratory experiments in this direction.

The effects of the treatment of water by iron may be classed under three heads: —

1. The invariable result is that the organic matter is altered in its chemical nature, and the albumenoid ammonia is reduced to from one-half to one-fifth of its original amount.

2. A reaction analogous to that in Clark's softening process appears in many cases to go on. The iron oxide which is produced by combining with some of the carbonic acid which holds the carbonates of lime and magnesia in solution in the water, causes some precipitation of these to take place, and hence an appreciable amount of softening generally results. Thus, at Antwerp, the boilers at the pumping-station were originally fed with untreated water; a hard scale was consequently formed in them; but when the arrangements were altered, and the treated and filtered water was supplied, the scale was greatly reduced in quantity, and became of a very open friable character, which does not adhere to the boiler plates. In the same way, when water contains much iron in solution, the treatment with iron causes a deposition of the metal on account of the removal of the free carbonic acid, so that the waters of the Nethe have less iron in them after treatment than before. It is very remarkable how completely the iron is deposited from solution in this process; the merest trace only remains, an amount not greater than the Kent Company's water, for example, contains. An idea prevails that, because iron is used in purification, the water resulting must necessarily be unfit for many purposes, such as washing linen, paper-making, and so on. I have not been able to find any grounds for this prejudice. Fish live and thrive in the water; it is used exclusively by the famous Zöological Gardens at Antwerp; aquaria are supplied with it; and no complaints about its injurious effect on linen have ever been received.

3. Treatment with iron appears to destroy or remove much of the infusorial life. According to Dr. Frankland, Bischof, Voelcker, G. H. Ogston and others, who have experimented in the laboratory, the treatment with iron prevents the development of that kind of microscopic life which is the cause of putrefaction of animal substances; and Mr. Ogston's experiments with sterilized infusions placed in sterilized chambers, and also with Dr. Koch's method, prove that the microbes causing fermentation and putrefaction are destroyed or removed.

At Antwerp, during the autumn of last year, the unusual drought, coupled with the great influx of visitors in consequence of the International Exhibition, made so severe a demand upon the purifying arrangements of the Water Company, that it proved impossible to remove entirely the marshy taste in the water. This caused considerable alarm, because the cholera was raging in Spain, and great fears were entertained lest it should travel eastward; the Town Council, therefore, appointed a Commission of five distinguished Belgian chemists to report on the condition of the water. The Commission made a very exhaustive examination, and reported that there was nothing deleterious in the water, that it was absolutely sterile to Koch's gelatine test, although life was developed by cultivation on potato slices. I do not venture to pronounce any opinion as to whether it is desirable or not to remove all infusorial life from water. There is no proof whatever, as yet, that it would be any advantage to do so, while there is evidence that microscopic life has the effect of naturally purifying water; and analogy would lead us to suspect that, just as small birds keep down insect pests, so some kinds of microbes, harmless in themselves, may be of great use in destroying dangerous germs.

It is well known that iron is inimical to vegetable and animal life. The presence of salts of iron in the soil produces sterility. Iron must not be used in the construction of aquaria, or of the pipes and pumps connected with them, for even creatures as hardy as eel fry show such strong repugnance to the water as it issues from the revolvers, that they make the most persevering efforts to crawl out of it, even up the vertical sides of the iron tank in which the water flows. It is not surprising, therefore, that it should prove inimical to microscopic life. It has been suggested that the presence of iron deprives the water of its free oxygen, and thus smothers animal life, and again it is thought that the slimy precipitate which is formed carries down and entangles the infusoria, and prevents them getting through the sand filters. However that may be, this property of iron is

[1] Proceedings of the Institution of Civil Engineers, Session 1885-6. Vol. 85.

undoubtedly established, and would lead to the inference that, supposing dangerous as well as harmless germs to be destroyed, the worst water treated by iron is safer for dietetic purposes than the best natural supplies, because protection from contamination of water artificially purified is under the complete control of the establishment supplying it, for it can be kept in covered reservoirs and pipes beyond all risk of pollution; whereas, the best natural supplies, used in their natural condition, those from deep wells not excepted, are more or less open to contamination; witness the number of wells that have had to be abandoned in the outskirts of London, and the obvious ways in which springs and water-courses can be defiled.

The adoption of iron purification by water-works deriving their supplies from rivers liable to periodic muddiness and discoloration from floods, would obviate the necessity of having large intake reservoirs for the purpose of storing up water, when the source is in a good condition, for use when it is too discolored and polluted to be drawn upon. Not only would such a course save a vast amount of valuable space, but it would remove the danger which must accompany the exposure of a vast surface of water to the contaminating influence of the atmosphere of large towns, and who can tell how fatal this may be on the outbreak of epidemic disease? The practice adopted largely in London, for example, is to convert running streams into stagnant ponds situated in the midst of a dense population, and surrounded by factories, and make such ponds the real source of supply.

The system which I have had the honor of bringing before you is now in operation on the large scale at Antwerp, at Gouda and Dordrecht in Holland, and at the great iron-works of Messrs. Cail & Co. in Paris, where the water of the Seine, considerably polluted by sewage and by the floating wash-houses, is taken from opposite the factory on the Quai Grenelle, and purified for the supply of the factory and the workmen's cottages. In addition, experimental apparatus of large size is in operation in Berlin, and at Ostende. In the case of the latter town, the object is to determine whether an abundant supply of good water, which the town stands much in need of, can be obtained at Jabbeke from a canal, the water in which, usually about the same quality as that of the Nethe, of which the Antwerp supply is derived, is subject to periodical pollution by the Espierre, a stream which drains a large manufacturing district. The apparatus has been at work since last spring, and has given very satisfactory results, the purified canal water being superior to any at present in use in the town.

A table of analysis, showing the degree of purification attained is appended: —

EFFECT OF PURIFICATION BY IRON.

	Organic matter.		Ammonia.			
			Albumenoid.		Free.	
	Before.	After.	Before.	After.	Before.	After.
Antwerp	77	31	.27	.08	.40	.00
Dordrecht	34	14	.14	.05	.12	.00
Gouda	151	85	.41	.23	.05	.03
Ostende (single purification)	135	76	.58	.22	1.30	.12
" (double ")	—	40	—	.19	—	.23
Paris	51	25	.16	.06	.40	.00

The distinguished Antwerp chemist, Mr. Kemna, has found that in the case of bad waters, a double purification is possible, the water being twice passed through the revolver and twice sand filtered. The results, in the case of Ostende, are given in the table. In his capacity as consulting chemist to the Antwerp water-works, Mr. Kemna has devoted much time and research to the process, and to him as well as Mr. Devonshire, the resident engineer, I am much indebted for many useful investigations and suggestions.

I will conclude this paper by exhibiting a laboratory apparatus, wherein the process which I have been describing is in actual operation.

The revolver before you is made of cast-iron, and has a capacity of one-and-one-half litres. It is charged with one-tenth of its volume, or one hundred and fifty cubic centimetres, of coarse cast-iron borings, and is caused to revolve by means of a train of wheel-work driven through the agency of a band by a small electric motor, the power required being about two-and-one-half watts. The water to be purified is placed in the glass vessel, above the revolver, and is siphoned over into it through the hollow trunnions by means of a glass tube and India-rubber pipe, fitted with a pinch-cock. The water is delivered from the revolver into a series of four tall jars connected together by glass siphons, so arranged that the contents of one jar are drawn from its bottom into the top of the next in the series. This arrangement is adopted merely to avoid the inconvenience of a single jar four feet deep. The last jar delivers, by means of a siphon, into a sand filter, arranged in a large glass breaker, the filtered water being siphoned over into a Winchester quart bottle. Beside this filter is a second one, in which, by way of contrast, the water being purified is filtered direct without the intervention of the iron treatment.

The fluid being operated on consists of Kent Company's water, contaminated by the addition of four per cent of a strong infusion of leather cuttings, which give it a strong yellow color, and the like amount of house sewage of a very pronounced odor.

The apparatus was started three hours before this meeting commenced, and was stopped as soon as the glass jars were full, in order to give the time necessary for the chemical action to take place, and restarted when the meeting commenced. You will, probably, be able to notice the difference in shade of each succeeding jar, the black deposit at the bottom of each, and the same on the surface of the sand in the filter. The dirty yellow water you see has been changed into a colorless fluid, while the same water, merely filtered through sand, retains nearly all its color, though it has become somewhat clearer.

I place into beakers a sample of the water supplied by the water company to this house, a sample of the water you have seen purified, and another of the same water unpurified, but filtered through sand only. I add to each beaker an equal quantity of a weak solution of permanganate of potash, and you will see, in a few moments that the purified water does not yield much in color to the water company's supply, while the original water has hardly changed color at all, the permanganate having been reduced by the impurities.

The cost of applying this method of purification depends, of course upon local circumstances, and the quality of the water to be treated; but the capital outlay, where filters exist already, may be taken as £1,000 per million gallons per twenty-four hours, while the working expenses are merely nominal, the revolvers running without any attention beyond regular oiling, and the addition, once a week, of a fresh supply of iron. The cost of the water at Antwerp, delivered into the town main under a pressure of two hundred and eighty feet does not exceed three-quarters of a penny per thousand gallons in working expenses of all kinds. Where filter-beds exist, as at Dordrecht and Gouda, in Holland, the revolving purifiers can be added without any substantial alteration, and the filter-beds can generally be worked at a greater rate than when the untreated water is to be made reasonably fit for use.[1]

LIME AND CEMENT.



A CORRESPONDENT addresses the editor of the *Scientific American* as follows: —

In your issue of the 9th inst., p. 231, you print an article entitled "Cement in Ireland," signed by one Robert Mallet, F. R. S., in which he states that Henri Sainte-Claire Deville, the illustrious French chemist, in the course of certain recent researches discovered that some certain compounds of hydrate of lime and hydrate of magnesia afford a cement of eminently hydraulic qualities, setting rapidly under water; that the natural dolomites, if calcined at a very low red heat and ground to powder, produce, without any other treatment, a fast-setting hydraulic cement, which becomes so hard that it may be employed as an artificial stone.

Mr. Mallet further adds: "The process which has been given to the world by Deville is hampered by no patent."

The process is not confined strictly to dolomitic rocks. Any magnesian limestone will answer the purpose fully, so Mr. Mallet states. Every few years some one discovers (!) that an eminently hydraulic cement can be produced from pure magnesian limestone; and, singularly enough, the discovery is invariably given to the world free. It is never "hampered with a patent."

This story generally follows in the wake of the sea-serpent story that we always like so well to read about. It is always fresh, always inspiring.

Probably three-fourths of the quicklime manufactured in this country is derived from the magnesian limestone formations. When this stone is calcined sufficiently to expel the carbonic acid, it is called quicklime; and when water is applied it gives off heat, expands, and falls to powder. It is then a hydrate of lime and hydrate of magnesia.

In this condition it is mixed with sand and water, and becomes mortar for masonry and plastering. The lime and magnesia are not chemically combined. It is simply a mechanical combination when in a pure state. They are both bases, containing no acid with which to form a salt.

Taken singly or together, neither of them contains the slightest trace of any setting or hardening properties.

They are, however, the bases that when intimately mixed with certain proportions of silica or silicic acid, and subjected to a high heat, produce silicates of lime or lime and magnesia, *i. e.*, an hydraulic cement.

When water is applied to these silicates, they crystallize and harden, whether in air or water, and will not dissolve by the action of water; while pure lime and magnesia, either singly or as a dolomite, will dissolve in water — will be taken up and held in solution.

[1] Further information may be obtained by reference to the "*Proceedings of the Institution of Civil Engineers*," Vol. lxxii, p. 24, Vol. lxxxi, p. 279 and p. 287; "*Journal of the Royal Agricultural Society*," Vol. xx, Part II, 1884, p. 681. "*Rapport sur la qualité de l'eau de la ville d'Anvers pendant l'été de* 1885." In the library of Institution of Civil Engineers.

This result cannot be changed by any manner of calcination or subsequent manipulation.

Not long ago an article appeared in one of the trade journals, stating that "the only way to produce silicate of lime was to mix common white or quicklime and sand together with water, and pile it up in a heap, and at the expiration of two or three weeks the whole mass would have become silicate of lime." This idea seems to be quite prevalent, but its absurdity is easily exposed; for, no matter how old the mortar may be, if the lime was pure and white, a few days' immersion will dissolve the mortar, thus proving conclusively that there is no chemical combination between the sand and lime.

A true silicate of lime cannot be dissolved by water. Impure limes, such as the gray or brown limes, always contain silica. Five to six per cent will not prevent active slaking, and the resultant mortar will contain fifteen to eighteen per cent of true silicates, and even this amount will tend greatly to the hardening of the mortar. It was probably through the use of these impure limes that people have been led to imagine that pure limes contain inherent setting properties — a theory that never has and never can be sustained.

U. C.

Notes and Clippings

The Legal Status of "Historical Monuments in France." — The courts have just decided in France a curious point. At Bourges there is a famous palace called the Hotel Cujas, which is an historical monument in itself, and as such was sold in 1879 by the Department of the Cher to the town for 80,000 francs. It was bought for a museum, but when the mayor began to alter it for that purpose the prefect of the department forbade all changes, because it is a public monument. The town complained that when it bought the place such limitation to its right of proprietorship was not understood. The court decides that the classification of a piece of real estate among historical monuments does not invalidate the rights of the owner, and does not invest the Ministry of Fine Arts with the power to oppose projected repairs. — *Boston Transcript.*

Microbes of the Soil. — The value of the action of microbes in the soil would not be questioned by any one who had given the matter sufficient thought. But to establish a conclusion by means of experiment always commends itself to the scientific mind. M. Laurent has made a series of comparative experiments in order to ascertain the influence of the microbes on vegetable life. Seeds of buckwheat were sown in four different kinds of mould. In the first flower-pot natural mould was employed; in the second the same earth sterilized and then inoculated with bacteria of the soil; in the third, simply sterilized mould; and in the fourth, sterilized mould with the addition of chemical manure. Precautions were taken to prevent contamination of the four receptacles (*Journal de Pharmacie et de Chimie*, No. 7). The production of wheat in each of the pots respectively was in the proportion of 94, 96, 23, 66. In all the experiments the third series was inferior to the others. The value of microbes in soil rich in organic detritus seems thereby to be proved. — *Lancet.*

Charlemagne's Hall. — An historic spot, noteworthy in the early life of mediæval Germany, is doomed to disappear beyond recognition. Ingelheim was a favorite residence of Charlemagne, where he built a great palace and monastery, and laid out pleasure grounds. From the hill where he had fixed his own dwelling he remarked the early disappearance of the winter snow from the Johannisberg and the slopes of Rudesheim, and he had vines brought from Italy and planted in these places, which instinct told him would produce good wine. This was the first introduction of the vine into Germany. Few remains of the buildings now exist. What their extent must have been may be inferred from the fact that from the Ingelheim hill to the Rhine is fully two miles, and yet the river is said, in all accounts, to have washed the palace walls. It is this hill and immediate neighborhood which is known among the people by the name of "Charlemagne's Hall." Some pillars were standing in the last century; but they have been long since scattered. One of them is preserved at Mayence. A great champagne grower, M. de Barry, purchased the property some years since. But he died, and it has passed into the hands of a limited liability company, who have had the place surveyed, and purpose letting it out in small peasant holdings. — *St. James's Gazette.*

Frozen *vs.* Kiln-dried Flooring Boards. — A well-informed lumberman vouches for the truth of the statement that frozen lumber occupies a smaller space than the best kiln or air dried; that is, that if two boards of the same size be taken green from the saw one will contract more under the influence of extreme cold than the other will through any artificial drying. An instance of this character is thus stated: A gentleman, now old, remembers how his father determined to lay a floor; but the proprietor of the old-fashioned saw-mill, on which the community depended for their lumber, had no dry stock — nothing but green logs which might be supposed to be frozen under the influence of the below-zero weather then prevailing. He was ordered to saw up those logs. The frozen lumber was taken just as it came from the saw, dressed off by hand, as usual in those days, and laid in the floor. Many years after, the son, who was a builder, put up a house for his own use, and built it as well as he knew how. He paid particular attention to the flooring, and himself superintended the kiln-drying of the strips. But in spite of all his care the floors shrank, and in a few years showed wide spaces between the boards. On the contrary; the floor his father laid of frozen lumber, after 40 years of service, showed not a crack — a knife-blade could not be inserted between the boards, and it had always retained its perfect surface. The story is an interesting one as showing that woods have peculiarities which are understood by but few. — *Northwestern Lumberman.*

The Story of a Greek Statue. — Visitors to the Louvre of late may have noticed a remarkable little marble statue labeled "A Young Athenian Girl." The story of its discovery and acquisition, just disclosed by the *Temps*, forms a curious page in the history of antiquities. A peasant of Patissia, while digging in the fields, suddenly came across an old statue. Knowing that the Greek law forbids the exportation of ancient objects of art found in the country, and that foreign amateurs are always ready to pay a high price for them, he at once took it home and hid it under a heap of fagots. He then went to the French ambassador, who was well known for his love for such relics, and offered it to him for 12,000 francs. The ambassador repaired secretly to the peasant's dwelling to examine it and found it was a *bona fide* gem of the fourth century. He telegraphed the discovery to the French minister of fine arts, who authorized him to conclude the bargain. But there was a serious difficulty to overcome, and that was to get it out of the country without being detected by the customs authorities. After some reflection the ambassador instructed the peasant how to set to work. He was to hide the statue in a cartload of vegetables, drive down to a creek on the seashore, where he would find a boat from the French sloop stationed at the Piræus waiting to receive him. The job was performed successfully. The statue, in the midst of the vegetables, was shipped on the boat, and the 12,000 francs was handed to the peasant by the captain as he left the shore. On the arrival of the statue in Paris it was placed in the Louvre, not far from the famous Venus of Milo, while its discoverer, the poor Greek peasant, is now leading the life of a small gentleman farmer on the proceeds. — *Pall Mall Gazette.*

Lord Elgin and the Parthenon. — Lord Elgin is made accountable for the vanishment of some of the frieze-work of the Wingless Victory. Without doubt Lord Elgin is a badly-used man. There is no nation that calls itself civilized but loves to cast a stone at his lordship. Even his fellow-countrymen, who have had all the profit of his depredations (to give them a hard name) do not spare him. And yet, if a man is to be judged by his motives, Lord Elgin deserves rather to be crowned with an olive wreath. Who could foresee the emancipation of Greece in Lord Elgin's time? And who, knowing with what scant esteem the Moslems looked upon the sublimest of human achievements, could aver that the Parthenon itself might not any day be blown pell-mell to the four quarters of the winds! The Turks, during Lord Elgin's residence in Athens, were accustomed to forage among the statuary of the city for the whitest bits of marble, sculptured or otherwise; these they would reduce to powder and serve up as mortar in their own building work. They were also wont to trundle columns and statues and capitals, and throw them indiscriminately among the dust and brick ends of their own building material; a mixture of all these together would surely make a good, substantial wall, quoth the Turks; while, worst of all, it was a custom with them, when their hands were idle, to scale this or that pillar or statue larger than themselves, and amuse themselves by knocking off noses and other chiselled excrescences until they were tired. At other times they would use the statuary as a target. Under such circumstances Lord Elgin moved for permission to take casts and drawings of those antiquities which still remained in Athens. It was granted him by the Sultan, and for three years six eminent artists and modellers were at work under his superintendence in this great task. A little later and he took the more mature step of trying to rescue from what seemed to him inevitable destruction certain of the ornaments of the Parthenon. The Sultan had no objection. All the marble treasures of the East were little to him save as valuable equivalents of gold and silver. And thus it was the friezes and other valuables which adorn our British Museum came to be transported from Athens to England. The Parthenon was at one time used as a powder magazine — a fact to be remembered when Lord Elgin is held up to scorn and execration — *The Cornhill Magazine.*

Sir John Soane's Museum. — According to the daily papers, the "secret chamber," or rather cupboard, in Sir John Soane's house in Lincoln's Inn-fields, was opened on Monday afternoon. The trustees present were Mr. Waterhouse, R.A., Mr. G. Goodwin, F.R.S., Mr. C. S. Percival, F.R.S.A., Prof. T. Hayter Lewis, F.S.A., Professor Flower, F.R.S., Doctor Freshfield, V.P.S.A., Doctor Richardson, F.R.S., and Alderman Sir R. W. Carden, together with the curator (Mr. Wild) and the solicitor to the trustees (Mr. Upton). On being opened, the cupboard was found to enclose a nest of sixteen drawers, to the outside of which was affixed a memorandum, of which the following is a copy, signed by the executrix of Sir John Soane's will, Sir Francis Chantrey, and two other trustees of the Museum, and the then curator:

"December 6, 1837.

"Pursuant to Dr. Lushington's opinion, this repository was opened by the executrix, in the presence of three trustees, to ascertain if there were money, notes, or valuables to require further probate duty, and after merely looking at the papers, etc., for that purpose, they were all returned without further examination, retaining for use some articles of stationery."

It is stated that a careful examination is now being made of the contents of the drawers, which appear, however, at first sight, to contain nothing of public interest, but only documents relating to various buildings with which Sir John Soane was professionally connected, and to a well-known family dispute. The worthy Sir John seems to have been addicted to mystification. — *The Builder.*

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. No. 576

JANUARY 8, 1887.

Entered at the Post-Office at Boston as second-class matter.

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THE announcement made a few weeks ago, that at the beginning of the year we proposed to grind up the remaining stock of the issues of the *American Architect* from 1876 to 1880 inclusive, has caused such a demand for these numbers at the reduced rate we named, that we have decided to keep the offer open until February 1. Until that date we will supply such issues for these years as remain in print, at the rate of five cents each — no order being taken for less than ten copies. This offer does not apply to complete volumes, bound or unbound, the price for which does not vary from the regular established rate. In this connection it may be well to state that we have in stock only two complete sets of this journal, and any individual, library or association that hopes ultimately to have a complete set on his or its shelves will do well to seize the passing opportunity.

AS several subscribers to the Gelatine edition have been puzzled by finding the word "regular" on the cover of the papers they received, it may be well to remind them that, except in the case of the last issue for a month, the Regular and Gelatine editions are identical.

THE *Firemans' Journal,* which appears in a new and handsome form, under the name of "*Fire and Water,*" tells a curious story about a fire which occurred lately at Fort Wayne, Detroit. The Government wharf attached to the fort took fire, and would have been entirely destroyed, but for the energy of Colonel Poe, commanding the engineer corps in charge of the place, who succeeded in attracting the attention of the people on board a tug-boat, and by means of the extinguishing apparatus belonging to the boat the fire was subdued. For the services of the tug-boat on this occasion the Colonel paid the owner the moderate sum of forty-six dollars, and forwarded a memorandum of the transaction to Washington, with a request that he might be reimbursed for his advance. After the usual delays the account came up for settlement, and, according to the story, was rejected by the Treasury Department, on the ground that as advertisement had not been made, and bids received for the services rendered by the tug-boat, payment for such services was unauthorized by law. Unless some one finds means to overcome this tremendous obstacle, therefore, the Colonel will have to lose, out of his small pay, the sum which he devoted to saving the public property from destruction. We doubt if anything in the annals of red-tape surpasses this story as an illustration of mechanical officialism. If it is true that there is no fund at the command of the United States Government which can be used to pay for putting out fires in public buildings, the attention of Congress should be called to the subject without delay, and an appropriation made; and meanwhile those who have public property under their care will do well to notice that in case a fire breaks out among the goods, or in the building containing them, they must, before calling upon any one to bring a pail of water, advertise for bids in several newspapers, specifying the nature of the service required, and appointing a day for submitting estimates, with surety for faithful performance, or they will be obliged to pay out of their own pockets the cost of fighting the fire. As conflagrations do not usually wait for bids to be submitted, and contracts made for putting them out, it is probable that most officers would consider it useless to do the advertising which the law insists upon, and would simply put their hands in their pockets and see the public property burn, and this, in the present state of the law, seems to be the only prudent thing to do.

ACCORDING to the same excellent journal, there has been recently a great increase in the amount of property destroyed by fire. Most architects are by this time quite alive to the importance of constructing buildings with a certain amount of precaution against fire, and there are few of them who do not know the best methods of doing so, but, although the practice of architects has greatly improved in this respect within a few years, the general public responds as yet but feebly to the representations of its professional advisers, and the resisting power of buildings hardly keeps pace with the increasing dangers incident to the accumulation of merchandise in the huge stores and warehouses now erected. Up to the first of December last, the fire losses for the year in this country aggregated one hundred and five million dollars, and it is probable that the total losses to January, 1887, will be at least one hundred and fifteen millions. About sixty per cent of this loss was distributed over the community by means of insurance. The remainder, although it falls nominally on the owners of the property destroyed, is really to a great extent distributed, in an irregular manner, through bankruptcies, enhancement of prices of all goods to cover cost of insurance, and in various other ways, so that the community really shares pretty uniformly the total fire loss, together with the cost of maintaining the officers and clerks of all the insurance companies in the country, which is probably nearly as much more. Another large item, for the maintenance of fire-departments and apparatus, must be added to the rest before we arrive at the cost for the year, to the citizens of the United States, of defective building and carelessness about combustible substances, and if we call the total outlay three hundred million dollars, which is probably not very far from the truth, and divide this by the number of families in the United States, we shall find that the cost to each family of fire protection and fire destruction has been for the year about thirty dollars. It may be said that the large property-owners pay the heaviest premiums and taxes, and that the burden therefore falls lightly on the poor; but the truth is that the large property-owners add the amount of the taxes and premiums which they pay to the price of the goods which they sell, and the houses which they rent, and those who have to live in the houses, or consume the goods, have, in the end, to pay the extra cost, and the rich man pays only a trifle more than the poor man because he consumes rather more goods. To make up for this, however, the poor man is apt to have more children than the rich man, so that the contribution of each householder to fire-losses is perhaps fairly stated at ten cents for every working-day, or sixty cents a week. There are few families where this sum, if it could be saved, would not add very appreciably to the comfort of life, and if it could be clearly shown that under the present system the comforts that this would buy are sacrificed without a murmur to foster the carelessness and selfishness of a few individuals, it might be possible to create a most salutary public sentiment on the subject.

UP to this time the officers of the mill mutual insurance companies have done nearly all the work in this direction that has been accomplished. So far as their efforts have been directed toward calling the attention of the public to the enormous losses which are suffered through avoidable causes, they have been made from pure public spirit; their own business, the results of which demonstrate most forcibly the truth of

their representations, being carried on in such a way as to involve no waste of time in argument. Next to them the architects, many of whom have published valuable treatises or articles on the subject, beginning, perhaps, with a remarkable essay written nearly twenty years ago by Mr. P. B. Wight, then a brilliant member of what was perhaps the most exclusive coterie of artists and architects in the country, deserve the greatest credit for their zeal in a good cause; and with them the list of those who have devoted much time and trouble to the subject ends. In one way the Underwriters' Association of New York has improved the character of constructions within its jurisdiction by a careful and judicious classification of risks, which is now being imitated in other places, but, so far as we are aware, the efforts of the insurance interest generally to enlighten the public mind in regard to good construction and avoidance of danger may be summed up in the publication of two or three small circulars, carelessly written, and containing nothing calculated to attract public attention, or to instruct any one who had ever taken enough interest in the subject to obtain information upon it from other sources. To most persons it seems plain that the underwriters, of all others, are the persons whose duty it is to undertake this work in an efficient manner. Under the present system, the insurance business is becoming every day less profitable. Even with premium rates as high as the public will bear, the underwriters complain that the losses equal the receipts, and the fact that a small diminution in the losses, such as might, we believe, be effected by an appeal to public opinion, would greatly increase the profits, which appears plain enough to the world in general, seems to be hidden from those alone who are most interested in it. To take the losses for the present year as an example: out of the one hundred and fifteen millions lost by fire, certain insurance companies will pay about sixty-five millions, or rather, will collect that sum from their policy-holders and hand it over to the sufferers. Now, supposing the premium rates to have been fixed at the beginning of the year, and the underwriters interested in these particular cases to have sent circulars to their policy-holders, similar to those of the mill-owners' mutual companies, or to have in some other way called attention to the ways in which fires should be avoided or checked, it is not unreasonable to suppose that, even without the discipline which the mill mutual companies exercise over their members, one person in sixty-five of the policy-holders would have been led to buy an iron match-box, or a tin box for oily rags, or to take some other small precaution which would have saved his premises from fire during the year; yet even with this small proportion of result from their warnings the underwriters for these buildings would have finished the year with a million dollars more to divide among their stockholders, or to pay salaries with, than they now have. In this country one can purchase a great deal of eloquence with a million dollars, and he must be a poor rhetorician who, with the materials afforded by the records of the insurance companies, could not compose an address to the public which would attract the attention of at least one person in sixty-five of his audience.

THE proprietors of the *Boston Herald* have joined the ranks of the pioneers in the way which is, we trust, to lead to the more equal distribution of material wealth, and the development of a higher character among those who work for wages, by inviting all their employés, during the coming year, to participate in the profits of their business. The details of the arrangement have not yet been made public, but the proprietors have adopted in general the features of the best and most successful participation schemes now in operation, protecting their men against business mischances, which they would as yet be hardly able to bear, by promising them their full wages in any case, and proposing, in addition to these, to set apart a portion of the net profits of the business, which is to be divided at the end of the year among those who have been employed during the year, in proportion to the value of each one's services, or, in other words, to the amount of regular wages which each one has earned. In connection with this, the proprietors suggest that a benefit association should be formed among their employés, after the method which is now becoming common, as a reliance in case of death or accident; thus happily joining, in the minds of their men, the prospect of an increased income, to be earned by increased energy and care, with the idea of putting aside a portion of that income as a fund for lightening the burden of the sickness and bereavement which must sooner or later come to every one. We shall expect to see a "boycott" ordered by the demagogues against the *Herald*, and against all the men employed upon it who accept the proposition of its owners, for countenancing an arrangement so well calculated to enable those who participate in it to "acquire some wealth," and thus become "monopolists," incapable of sympathizing with the feelings of "working men," who, in the Socialist theory, are always supposed to be paupers; but we know that the owners, at least, have courage enough to bear a little martyrdom in defence of the faith which they have adopted, and the men who, by accepting their terms, join with them in carrying out their plan, could hardly have better leaders in the struggle which is sure to come, sooner or later, between the real friends of working people, who wish to teach and help them to provide for themselves, and the pretended ones, whose interest it is to keep them poor and dependent.

ANOTHER noteworthy effort to help working people is, according to the newspaper reports, to be made by Senator Stanford, of California, who proposes to introduce a bill into Congress which shall facilitate the association of men of small capital to carry on industrial enterprises. In the early days of California, as he says, it was common for miners, without any capital whatever, to form an association for some given purpose, usually in the way of an engineering work in aid of mining operations, and complete it successfully by their own efforts, although the scheme sometimes involved the construction of aqueducts many miles in length; and he believes it possible, we suppose by legislation regulating the duties and liability of the participants in such an enterprise, to make coöperation of this sort safe and profitable for men possessed of the energy which, with the miners, took the place of capital. There is no doubt that something of the kind can be done, and Senator Stanford's plan is likely to be a well-studied and efficient one. In France, the bitter labor struggles of four or five years ago have resulted in what seems to be the permanent establishment of associations of workmen, with small capital, but well equipped with French industry and common-sense. Those associations which made a business of building were for a long time excluded from competing for public work, on the ground that their capital was too small to furnish the guarantee of responsibility, which the public interest required, but their prudent conduct of their affairs has advanced them so rapidly in the general estimation that a year or more ago they were formally admitted to tender for public buildings on the same footing as private contractors.

A LETTER to the New York *Times* asserts that a plan has been for several months under consideration by the best French engineers, for the construction of a number of locks on the Panama Canal, and some details are given which certainly convey the idea that this is not only intended, but that it would probably be the most prudent step that the Company could take. According to the last official report of the Directors of the Company, every part of the work on the canal has now been contracted for, and an enormous amount of excavation has already been done, but it seems that two excellent sites exist for building dams, and thus forming a lake at the middle part of the canal, with locks at either end, by which a vessel could be raised to the lake level, and then lowered to the sea-level channel at the other end; and this arrangement presents such advantages, at least as a temporary measure, that it seems not at all unlikely that it may be adopted. The greatest benefit to be derived from it would perhaps be the provision which it would afford for utilizing the Chagres river, which, instead of needing to be turned from its course, at great expense, would serve as a feeder for the upper-level canal; but as the lake locks would take the place of the tidal locks of the sea-level canal, there would be a still further economy, independent of the great saving in excavation which would follow from making the bottom of the middle portion of the cutting, for some twenty miles in length, a hundred feet higher than the ends. The idea of interrupting the canal with locks has been familiar enough ever since the enterprise was first projected, and there are many reasons why an elevated lake, connected with the sea by a short but narrow canal with locks, would not be much less convenient for navigation than a long, narrow channel without locks; and if a waterway of the former kind can, as is thought, be completed in two years, it will come at once into service, and the matter of deepening it may be deferred until it becomes evident that the traffic requires it.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — VI.

SKERRYVORE LIGHT-HOUSE.



THE light-house at Skerryvore is another of those remarkable structures, of which Eddystone was the type, which we owe to the genius of the Stevenson family.

The cluster of rocks opposite the west coast of Scotland, the largest of which is known as the Skerryvore, have long been a standing menace to the mariner, and, from the great difficulty of access to it, exposed as it is to the full fury of the Atlantic and surrounded by almost perpetual surf, the erection of a light-house upon it has always been regarded as a most formidable undertaking.

The success of Stevenson, the elder, at Bell Rock and the valuable experience gained there warranted the attempt to erect a similar structure at this place, as its importance as a light-station was too evident to require argument.

A long list of disasters, comprising the total loss of many vessels and of most of their crews, is a melancholy proof of the dangerous character of the reef and of the need of a light which would convert it from a source of danger to one of safety.

As the plate shows, the Skerryvore reef is a tract of foul ground, consisting of a number of small rocks, many below the level of high water: the surface of the principal rock on which the light-house is placed measures, at the lowest tides, about two hundred and eighty feet square. It is extremely irregular and is intersected by many gullies of considerable breadth and of unlooked-for depth, which leave it solid only to the extent of one hundred and sixty by seventy feet. One of these gullies, at the southeast corner of the rock, formed the landing-creek after clearing it by blasting under water; its sides and bottom were left comparatively smooth, and a landing could be effected here when the rocks were elsewhere inaccessible.

Another gully, immediately to the southeast of the light-house, was quite a natural curiosity; it was found to undermine the rocks for eight or ten feet and to terminate in a hollow submarine chamber which threw up a jet of water about twenty feet high accompanied by a loud noise like the snorting of some sea monster. Notwithstanding the beauties of this jet, it was a source of considerable discomfort and inconvenience, as it drenched any one whose work carried them near it. One calm day, at a very low tide, Mr. Alan Stevenson explored its interior by means of ropes and a ladder: he found the cavern to terminate in a polished spherical room, about seven feet in diameter, its floors strewn with boulders whose incessant motion had hollowed it out of the veined rock and rendered its interior beautifully smooth and glassy. As the cavern penetrated too far toward the place which Mr. Stevenson had selected for the site of the tower he changed somewhat the location of the foundation, and he also filled the cavern to prevent the discomfort of being drenched by the column of water which spouted from it even during calm weather.

Another peculiarity of the rock, in addition to its shattered and disjointed appearance was the glassy smoothness of its surface, which proved throughout the whole duration of the work, but especially at its commencement, a serious obstable and hindrance to the operations. At first sight this peculiarity may seem to be of little moment, but, as landings had often to be made in very bad weather, there was considerable danger in springing from a boat in a heavy surf upon an irregular mass of rocks as smooth and slippery as ice, and many awkward accidents occurred. The foreman of the masons said it was "like climbing up the side of a bottle."

During the progress of the work the rise and fall of the tides was measured — at high spring tides the rise was from twelve to thirteen feet, and three feet at dead low neap tides. The velocity of spring tides is between four and five miles, and of neap tides between two and three miles an hour. Although an act of Parliament in 1814 provided for the erection of this light, yet the undertaking appeared so formidable it was not until 1834 that the Light-house Board of Scotland took any measures to carry the provisions of the act into effect.

The first thing done was to make a careful survey of the site, an operation attended with much labor, as in connection with the work it was particularly desirable to have exact details of the depths, rocks and shallows of the surrounding sea with the nature of the bottom accurately laid down. This information afterward proved extremely useful during the progress of the work, as some of the vessels lying near the rock were frequently driven, by change of wind, to seek shelter among the neighboring islands.

Up to this time seamen knew but little of the extent of the reef. On one occasion a vessel was boarded within three-fourths of a mile of Skerryvore, between it and a rock known as Bo-rhua, or red rock. So little did the captain know of his proximity to these dangerous reefs that he was found lying at ease on the companionway, smoking a pipe, with his wife sitting beside him knitting stockings.

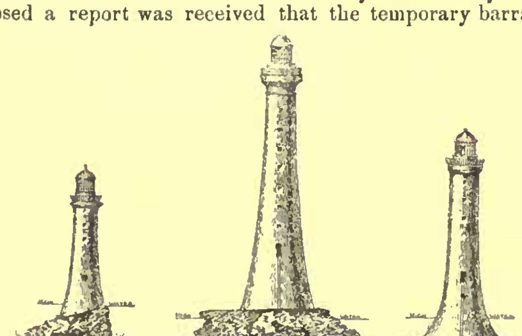
During the survey Hynish, a creek twelve miles from Skerryvore, was selected as a site for the work-yard and harbor for the vessels. The Duke of Argyle gave free permission to quarry materials for the purpose of a light-house on any part of the Argyle estates, and during the summer of 1836–7 about 3,800 feet of gneiss rock were quarried and a rip-rap wharf or pier was commenced to improve the harbor at Hynish. In 1838 a steam-tender was ordered and a contract let for building a temporary barrack on the rock.

Mr. Alan Stevenson chose an outline for the Skerryvore tower different from either the Eddystone or the Bell Rock, as the accompanying sketch shows.

The outline of the Skerryvore approaches more nearly to a conic frustum than either of the other two. This shape was chosen so that the thickness of the walls at the top might be increased — besides, the more nearly the walls approach a perpendicular the greater pressure is exerted on the stones near the base, and operates to prevent them from being drawn from the wall as well, if not better than by any system of *dovetailing* or *joggling*, devices chiefly useful in the early stages of the work when it is exposed to storms and before the tower is raised to such a height as to prevent the seas from breaking over it. Consequently, the other important differences in this work from the others was the absence of dovetailing and joggles between the courses. During the early progress of the work the stones were retained in their places chiefly by common diamond joggles, and the courses were temporarily held together with wooden treenails, like those used at Eddystone and Bell Rock. Ribbon joggles were used in the higher part of the tower, where the walls begin to get thin, both to prevent any tendency of the stones to spread outwards, and also to make a better joint against the intrusion of water. The walls were also tied together at various points by means of the floor-stones which were connected by dovetails let into large circular stones, forming the centres of the floors.

The first season's operations consisted solely of fixing in place the beams forming the pyramidal support for the temporary barrack; this was accomplished with great difficulty and danger, and the disgust of Mr. Stevenson can well be imagined when he was informed of its total destruction the following winter.

The next year, 1839, a stronger framework was put up, the barrack-house built upon it and the levelling of the rock to receive the foundation of the tower began. The cutting of the rock to a level surface was mainly done by blasting; injury to the men, who were of necessity in close proximity to the blasts, was avoided by covering the mines with mats made of old rope. It is of some interest to note that Mr. Stevenson made use of a galvanic battery to fire the mines, though its use was mainly restricted to blasts under water, or when several blasts were to be fired simultaneously. After the year's work was closed a report was received that the temporary barrack had



Eddystone. Skerryvore. Bell Rock,

again been destroyed; this, fortunately, proved untrue, the damage being confined to the loss of all the timbers and other material which had been left lashed to the rock, and of the moorings of the tender.

The next year found the barrack all secure, and the stock of provisions left in it for the use of any seamen who might be wrecked on the rock was in sufficiently good condition to be used by the workmen who, with Mr. Stevenson, took up their abode in the barrack, — a comfortless residence in stormy weather, when, for days together, it was impossible to descend to the rock, and it was impossible to keep warm except by remaining in bed.

The plate shows the nature of their singular dwelling; immediately under the tower was a wooden gallery for the storage of coal, tool-chests, beef and beer casks, and other materials which could not be safely left on the rock itself. The floor of this gallery was removed at the end of each season so as to leave free passage for the waves during the winter storms. Next came a kitchen and store-room, which, curtailed as it was by the seven beams passing through it, contained a caboose capable of cooking for forty men, and various cupboards and lockers lined with tin for holding the provisions.

The room above was divided into two apartments, one for the superintendent of the landing-gang and the foreman of the masons, the other for Mr. Stevenson.

The highest apartment, surmounted by a ventilator, was lined round the sides with four tiers of berths or bunks, capable of accommodating thirty people. The closeness of the room was most intolerable, especially during the heat of summer. These were, indeed,

[1] Continued from No. 569, page 240.

cramped quarters for so many people when it is considered that this odd, twelve-sided house, perched up like a bird-box on a pole, was only twelve feet in diameter.

The following was the daily routine when weather permitted: the men were roused at half-past three in the morning; at four the work commenced, breakfast at eight, for which half an hour was allowed, work until two, when there was another half hour for dinner, when the work was again resumed and carried on till seven, eight, and even nine o'clock, when anything urgent was on hand; supper was then eaten in the cool of the evening. These protracted hours produced continual drowsiness, and any one who sat down generally fell asleep.

The ceremony of laying the foundation-stone was performed on the 7th July, 1840, by His Grace, the Duke of Argyll, who was accompanied by the Duchess of Argyle, the Marquis of Lorne, Lady Emma Campbell, and a party of friends; he left a donation of £10 to be divided among the workmen.

During the year the tower was carried to the height of eight feet two inches, and contained a mass equal to 10,780 cubic feet, not much less than the whole mass of Smeaton's Eddystone tower. From this time forward the building of the tower made comparatively rapid progress, and finally, on the 21st July, 1842, the last stone was successfully laid.

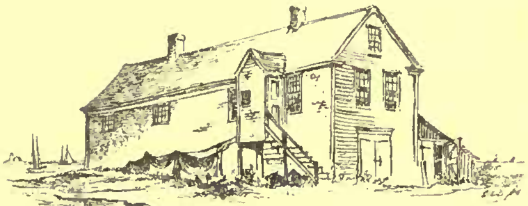
The masonry of the tower is one hundred and thirty-seven feet high and contains 58,580 cubic feet, weighing about 4,380 tons.

The lantern was placed the same year, and the work for the season was closed on the 14th September. In 1843 the interior fittings of the tower were completed and the light was exhibited to the mariner on the night of the 1st February, 1844. In the course of the summer of 1844 a marble tablet, bearing an inscription in letters of gold was, by orders of the commissioners, placed over one of the windows in the visiting officer's room.

THE SEARCH FOR AN AMERICAN STYLE.[1]

[It would be an injustice to the author of this paper to publish it with the meagre editing it has seemed to us advisable to bestow on it, without reminding our readers that not only is he a foreigner by birth (though now a most enthusiastic citizen), and as such more prone to the use of colloquialisms than one to the manor born, but that his lot has for many years been cast in the South, where the dialects used by the uneducated mountaineer, the poor white, and the negro have inevitably had an effect on the everyday speech of all classes, and lend to it a raciness which is perhaps as effective as the more labored metaphor of the closet student. — *Eds.*]

"Hear me for my cause." — *Julius Cæsar.*



A bit of old Provincetown, Cape Cod.

As you all very well know I have been looking forward to the good time coming, for a long period past; have been thinking and working and fussing and fuming, and at times cussing, over this problem of a legitimate, healthy and respectable architectural form of our own. I see a glimpse of daylight through the murky clouds in an occasional return to good sound sense, but withal too rare as yet to be much elated over. In our own craze for new things we often take very bad things, if only new. I deeply deplore this tendency of late years, of at times keeping everything so inordinately plain and crude that it often looks as though the rudest kind of man had built it, and the crudest kind of man had designed it; or in the other direction, for the sake of a new thing we often see some one of the well-known styles, handled with rough hands and bunged up unmercifully. We are so determined to have something new at all hazards and as raw crudeness was easiest attainable we "went for it," and are going for it considerably yet it seems. We have ransacked everything between the Queen Anne and the Mother Hubbard styles of architecture; we take from here and there, and don't call it stealing; it has n't occurred to us that we have about passed the years of our tutelage, and should begin to raise our own crop. This idea of piracy in art matters is not new; when the Romans conquered Greece, they carried away many valuable art treasures and the artists too, yet how could these sing the songs of Zion in a strange land? The early Christians were the worst of all pirates; they took the materials of the heathen temples and built their churches with them.

It seems a curious fact in the history of art matters, that whenever man got so clumsy that he could n't make beautiful works of art himself, he always valued them and bought or stole them, for he wanted them. It seems to have been reserved for our day to say we don't like it, for it is common-place stuff. A remark I have often heard about French decorated ornaments is that it takes too much thought and study to draw them, and the contractors don't like to make them. The kind of job ours down South like best, is the kind where they can shove a car of lumber and a nigger into one end of the machine, and the nigger comes out with the bank-check for the job at the other end. It is a much easier way out to throw contempt on the whole business, and try to persuade the world they are commonplace, that this can all be done with "chin-music," and it is easy and pleasant too, for we are very much like the old Dutch professor, who answered when a young lady deploringly observed that it must be dreadful hard work to read such long papers before these scientific societies: "No, no, the hard work is to be oblige to listen to de odder ones."

I noticed with considerable interest a series of papers on American Homes in the *Century*, watching for some suggestion from so profoundly learned a source, that might help us out of our apparant muddle; but the writer's caution in this direction transcended his learning, he gave but one hint and that was that we might take up the unfinished Romanesque style and finish it up: eternally teaching us that if we would be very nice we should imitate some very fine gentleman from afar! We have ransacked everything easy from the Queen Anne down to the Mother Hubbard styles, as I have said before; a good many of our late publications favor the latter as the very latest importation from old England, the nobbiest thing out; the fact that we should do something on our own hook does n't seem to take hold of us. Our thoughts run very much like those of the young man, whose father chided him, and told him to quit sowing his wild oats, and take him a wife and settle down. The young man thought he would, and asked his father "Whose wife shall I take?"

The old Texas preacher's method of getting good servants is our way out: an old lady complained very bitterly about her trouble with her servants to the old parson, when he replied, "We have none of that trouble at our house." The old lady inquired, "Where on earth did you get them from." "Oh," said the parson, "I married one and we raised the rest." We are married and ought to go raising something for ourselves. It is high time that we should assert ourselves and say to the world, "*Wir sind auch ehliger Leute Kind, Wir nicht auf der Strasse gefunden sind,*" which translated means, "We, too, were born in wedlock, we were not picked up in the street."

There are a great many people looking up this matter now — there never was a time when the craving for something new was greater than just now. In the *Decorator* a short time ago one of the contributors promised to ransack the Aztec ruins of Central America for some new styles; I expect they will be very nice, especially the dress-patterns of the Aztec young ladies. This artist once more repeats the young man's "whose wife shall I take?"

But the man wielding the most pernicious influence of our time, is he who forms a large percentage of our artists; he fills his studio with all sorts of incongruous rugs, curtains, *bric-à-brac* and truck of every description, throws healthy drawing, anatomy, perspective and everything that takes hard work and close application to the dogs, and covers his canvas with a fog, and calls it feeling; he lengthens Greek columns to any number of diameters, the goddesses and female figures to, at times, twelve heads high, as shown by some superb engravings in the magazines of a most elaborate engraving of the stairway of Hartford Capitol, — the centre of a cap in the foreground was at least one-sixth or one-fourth out of centre, and yet this is the stuff that presumes to lead the million! We do want something new, and are trying to get it without hard work, and it can't be done. In a disquisition on architecture, one author gave us a rugged mountain scene, with a rivulet coming forward in sunlight, and told us here is beauty, but did n't tell us how or where we could apply it. I never could catch on where any idea of it would fit into a building scheme; he about as lucidly discoursed about the vine, and in his foliage I found, only by referring to Number 12, on the Key, that Number 12 were meant for oak leaves. He gave us a sketch of the Greek enthemion, he had evidently drawn it himself, it looked like — as though somebody had made it himself, and he closed up by drawing a fence-corner with some luxuriant ferns forming this line (?) at the ends, and gravely told us here is a suggestion for a decorative ornament. That was true, but I have seen that form one hundred times in rococo: Colling gives exactly that kind of a leaf with minutest detail. I used the form two years before the article appeared on a pillar capital in St. Philip's church in Atlanta, and yet here comes this learned dude, and in all seriousness offers it to us as something brand new, just from the store.

Now I have always agitated for a systematic effort in this direction by the profession, and have been often told this thing must grow, that it can't be made to order. Yet I ask, in whose hands is it to grow, if not in those of the profession? Neither the Texas cowboy nor the metropolitan dude will do anything towards it. It is the skill and learning and earnest thought and study of the profession that will do all that will live in this direction, because whatever is not the outcome of serious thought, backed up with positive and exact knowledge will be transient, it won't live; it is only trained hands that can hope to successfully grapple with this subject, and it is the problem for us, and not for the cowboy, don't let us forget that.

A large percentage of the emanations of the present day are stillborn, and no wonder. The style often changes before the house is finished, and yet the fact remains that the beautiful, the good and the true are Three Graces, and will be to all eternity, while we are flying round like a bee in a tar-bucket. Let us learn wisdom from the experiment of past ages, don't let us steal their forms. If you feel like taking an idea from somewhere or somebody else, do it, but do it like the good boy, who says thank you when he takes anything, don't try to spirit it away like a pickpocket.

[1] A paper by Mr. John Moser, F. A. I. A., read at the recent Convention of the American Institute of Architects held in New York, December, 1886.

I found one idea in architectural form since last I saw you that I think will be profitable for all of us to bear in mind in our decorations. Decorative forms are trifles to be left to the whim of our draughtsmen. I seem to hear some one say the arrangement of the plans and the grand massing of the whole are the all-important things. Well, perhaps so; but I notice the average young man doesn't go raving over a well-formed woman with a clumsy, stupid face, as he will over one whose countenance sparkles with intelligence; besides, the great Michael Angelo gave us a rare bit of wisdom when he said "it is true that perfection is composed of trifles, but, don't forget it, perfection is no trifle." Some trifling changes in the Venus de Milo will degrade her to the level of the cigar statue. The great secret of the sweet laceiness of the carving of Richardson's work lies in the use of the spike-point and v-groove modelling interspersed with sharp, deep incisions. The Greek foliage possesses the same characteristics. Every idea of rarest beauty in our art, except the domination of the vertical line and the naturalistic foliage of the Gothic, these wonderful Greeks had and utilized. In the combination of these two ideas lie the possibilities of our time and for us. For a large ornamental composition, like a capital of a column, etc., the main lines must ever be architectural or conventional. The designer needs a particular mass or form, and must invent it, for it doesn't grow in the woods as he wants it, and herein he impresses his individuality — he gives it his character, and it will be as heavy or as light as he is himself, and, let us never forget, it takes a big man to do a big thing. Now, when we have the main lines, the frame or skeleton, let us dress it up as it may require, utilizing the sharp, elongated spike-point, and sticking to the v-groove modulation, with a reasonable number of bold, sharp incisions. Do it in our own way; don't let us attempt to make it Celtic or Greek, for the finer subtilties of the latter will most assuredly elude our grasp, before we are done with putting it into our harness, but let us be content with the possibilities of our own calibre. We won't reach any more, any way, no matter how much we try.

Well, when our main lines are fairly dressed up, balanced and harmonized, then in the spaces between, straggling here under and there over the conventional lines and forms of the skeleton, let us use purely naturalistic forms, as fine, crisp and subtile as they grow outdoors; let there be no conventionalizing the naturalistic further than to make them possible for stone; but let the conventional be as severe as possible — by this mode of procedure we will get something new and our own. The French Neo-Grec and Colling in his "*Art Foliage*," though actuated by the same thoughts, are yet as far apart as a Frenchman and an Englishman are different. They brought their conventional towards the naturalistic and conventionalized the natural taking the force out of both. If we keep them severely apart, we shall gain what is lacking in them all, that is, contrast, and if we apply a reasonable amount of skill, we shall excel them all by this procedure. There are a large number of places where but small ornaments are necessary, such as the ending or stopping off of a moulding, usually closed by a conventional curly-wiggle. For this purpose I have seen nothing so practical and effective as a simple naturalistic leaf, or combination of a flower and a few leaves, laid right over the end of the moulding. We may be asked by the old academic professor, what holds them on? There should be a string to tie them on, etc. Well, the string and ribbon, etc., clutter up our business too much, and I should give them the benefit of the doubt; trust luck about their falling off if carved in stone, without the string or hanging apparatus of any kind, just laid over the place. The single leaves of the horse-chestnut, the maple, the sweet-gum, the fern, the oak, the acacia, a bunch of violets with a leaf or two, a rose and bud and a leaf, a few ears of wheat or barley, and the thousand and one beautiful forms of nature. If one is not large enough, make a bunch of two or three of them, or double them or triple them in size. Don't overcrowd them, but make them rigidly naturalistic. A round bead in a cluster of mouldings, with a stem wound spirally around it, with occasional leaves, buds, etc., treated very close to nature, makes a very beautiful combination.

As you all know, the mouldings form the architectural lines necessary for contrast to the naturalistic, and the latter giving expression of a thought in the composition; that is, if we put any thought in it — and let me here once more reiterate the old maxim that an ornamental composition becomes a work of art when it expresses an idea or thought, but when it tells no story it is filagree. A composition all conventional is apt to become tame, and one all naturalistic is apt to turn wild, but when the two are united, the one will keep the other in the traces.

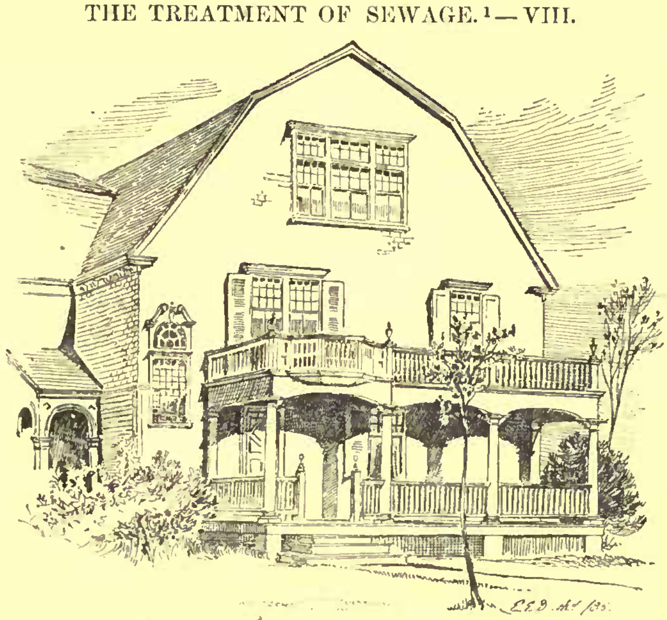
One important point should not be forgotten: that is, that the effect of the whole is very seriously heightened or lowered by the more or less persistent and systematic treatment throughout the whole; there must be no let-up anywhere. The same idea should be carried rigidly through, with no repetitions in the naturalistic, as there are no two blades of grass alike. This would require a higher grade of skill, both in the design and the execution, than our present affairs, but refined art will rather court difficulties than seek smooth water, and if we expect to receive the admiration of the world we must command their attention — command it, neither soliciting nor begging will bring it.

I have listened to a great deal of chaff at different times, about the respectable mediocrity of the work of the Government office, and I want to give you a piece of information, and that is that I know men there capable of challenging anything in America, no matter how tall, and quite a number of small fry capable of handling the little two penny fellows outside, that often make the most noise. One new scheme I would like to see tried, and here suggest it to your consideration, and that is that the Government office become a part of the educational system of this country (I mean in our line) similarly as was done with the Cathedral of Cologne sixty years ago. Say, give a certain number of graduates of the various schools, as prizes for the highest honors, say a two years' appointment in the office, with the usual salary — one year in the draughting-room, and one year as assistant-superintendent at one or the other of the buildings. This would first confer a benefit on the young men, and would eventually seriously help to Americanize our architecture as well as elevate it.

The young men would bring the influence of all the American schools to the office, and carry the influence of the office with them when they go out into the world on their own hook.

Now to reiterate a proposition regarding a style of architecture of our own that will be legitimate and will live: 1. Aim to unite the quiet serenity shown in the Greek with the heaven-aspiring tendency of the Gothic. 2. Aim to have the proportions as agreeable and the whole as harmonious as the Greek. 3. As agreeable as the French. 4. As vigorous as the English. 5. As refined as the Florentine. 6. As systematic as the German. Use the conventional and naturalistic decorative forms, as before laid down, making the decorations tell as interesting a story as we know how; let every detail tell of earnest thought and solid study, and the time may come when foreigners will copy as eagerly from us as we now do from them.

THE TREATMENT OF SEWAGE.[1] — VIII.



PHOSPHORIC ACID, MAGNESIA AND LIME.

HERAPATH'S Process — Blythe's Process. — The object of this mixture as a sewage precipitant is to fix the ammonia (as an insoluble ammonio-phosphate of magnesia) which in the employment of lime, or iron and alumina salts, remains in solution in the effluent, and consequently is lost. The lime, however (in common with iron and alumina salts) precipitates the phosphoric acid in the sewage. The use of sulphate or chloride of magnesium as a precipitant, in order to form the insoluble ammonio-phosphate of magnesia, was first suggested by Sir James Murray. Herapath, in 1853, patented a process for the use of magnesia or one of its compounds, in order to precipitate the ammonia and phosphoric acid "at or about the same time as the deodorization of the same sewage is effected by the addition of some chemical agent which will not decompose ammonia or its salts."

With this object he employed a mixture of 1 part of sulphate of iron, and 4 parts of burnt magnesian limestone. The process was tried at the Sewage Works of St. Thomas, near Exeter, but proving unremunerative was abandoned.

Murray and *Herapath's* process did not meet with the approval of Hofmann and Witt, on the ground that 1 part of the ammonio-phosphate of magnesia is soluble in 45,000 parts of water containing free ammonia and in 15,000 parts of pure water, whilst in a water containing a salt of ammonia, it was soluble to the extent of 1 in 7,000 parts.

In 1858, *Blythe* (Consulting Chemist of the Board of Health) patented the use of a solution of phosphate of magnesia in combination with lime or other precipitating agent.

The following is his description of the process: —

"Superphosphate of magnesia is first to be prepared by the mutual decomposition of superphosphate of lime and a salt of magnesia, the

[1] A paper by Dr. C. Meymott Tidy, read before the Society of Arts, April 14, 1886, and published in the *Journal* of the Society. Continued from No. 574, page 304.

superphosphate of lime being obtained from bones, bone-ash, apatite, phosphorite, coprolite, phosphate of alumina, phosphate of iron, phosphate of copper, or any other substance containing phosphoric acid, by the aid of sulphuric or muriatic acid, or other acid, the proportions being, in the case of phosphate of lime, one ton of phosphate to half a ton of sulphuric acid of commerce, previously mixed with three times its weight of water, or three-quarters of a ton of hydrochloric acid of commerce diluted with twice its weight of water. These are allowed to stand together for two or three days, being frequently stirred, and then they are mixed with a ton of sulphate of magnesia, dissolved in a small quantity of water, say a little more than its own weight. Powdered charcoal is then added in sufficient quantity (about one ton) to bring the mixture into a solid and convenient form for transport. When used for the purification of sewage, it is to be dissolved in water, and added to the sewage in the proportion of five parts of the phosphate to every 100 parts of solid matter in a gallon of the sewage. The whole is then to be well mixed and thoroughly incorporated by means of an agitator. If the sewage does not contain enough free ammonia or other alkali to neutralize and precipitate all the superphosphate of magnesia, lime is to be added in the form of milk of lime, until the sewage is faintly alkaline to test paper. By this means the ammonia-phosphate of magnesia is thrown down as a flocculent precipitate, which carries with it, after the manner of a clarifier, any insoluble impurities suspended in the liquid. In like manner, instead of lime, he claims the use of any other alkali or alkaline earth, as potash, soda, magnesia or magnesian limestone or alumina. He thus produces a valuable manure, containing, as he supposed the ammonia, as well as the nitrogenous organic matter of the sewage, and the phosphoric acid employed; 'while the supertanant liquor being freed from ammonia and nitrogenous matter, liable to undergo putrefaction, becomes deodorized, and may be either applied to the irrigation of land, or run off into the ordinary channels of drainage without fear of creating any nuisance or offence.'"

Way, in 1861, in the second report of the Commission to inquire into the best mode of distributing the sewage of towns, condemned the process as the most costly of all the plans that have been proposed, but on grounds that scarcely commend themselves to our judgment. I am ready to admit that the process may fail in removing the ammonia to the extent indicated by the patentee, but how it can possibly fail in removing the phosphoric acid (I am arguing now on chemical grounds), as Way's analysis shows, is beyond comprehension. The only explanation can be that Mr. Way did not use sufficient lime.

Many experiments were made with Blythe's mixture, of which the following are illustrations. Superphosphate of magnesia was added, in the proportion of 10.3 grains of phosphoric acid per gallon, and then an excess of lime until the sewage was faintly alkaline.

	Matters in solution.				Matters in suspension.		
	Total solids.	Phosphoric acid.	Ammonia.	Oxygen required.	Total solids.	Organic.	Mineral.
Metropolitan.							
Raw sewage.	68.33	.64	6.33	2.54	47.42	27.51	19.91
Effluent.....	90.02	.60	6.24	1.41	0	0	0
Coventry.							
Raw sewage.	46.61	.53	1.16	.78	21.11	8.87	12.24
Effluent.....	68.07	.05	1.06	.43	0	0	0

The dried precipitates had the following percentage composition :—

Organic matter	28.06	12.16
Phosphate of lime................................	27.11	32.65
Earthy matters	35.30	45.60
Sand, etc., ...	9.53	9.59
	100.00	100.00
Nitrogen equal to ammonia	1.61	0.99

The process purified the sewage successfully. One ton 3 cwt. of the superphosphate compound and 4 cwt. of lime was found on an average to be required for 1,000,000 gallons. This produces 3 tons, 1 cwt. of a manure valued at £3 14*s.* per ton, the chemicals and labor to produce which cost £1 15*s.*, leaving a net profit of £1 19*s.*

Blythe's later experiments showed that the magnesian compound might be omitted, and that the precipitated phosphate of lime was as valuable for plants as the original superphosphate.

Arrangements had been made to try the process at Southampton and Leicester, but fell through owing to the death of the patentee.

PHOSPHORIC ACID, LIME AND ALUMINA. — PHOSPHATE SEWAGE PROCESS.

The patent of *Mr. David Forbes*, F. R. S., and of *Dr. Astley Paston Price* was taken out in 1878. In consisted in the use of an acid solution (sulphuric acid being generally employed) of natural phosphate of alumina, with or without lime or carbonate of lime. The object was to employ a precipitant of manurial value, in order to obtain a compost of high fertilizing power.

The phosphate of alumina was obtained from the West Indies, where it occurs in such enormous quantities, that on one island alone the deposit is estimated at 9,000,000 tons. It contains about 38 per per cent of phosphoric acid and 25 per cent of alumina, with about 2.5 per cent of peroxide of iron. It was formerly supposed to be phosphate of lime, but analysis shows that the material does not contain more than two per cent of lime.

The following is the description of the process given by the patentees: —

"In carrying out the invention they say, we firmly submit to the action of sulphuric or muriatic acid the natural phosphates of alumina; which phosphates of alumina are capable of being decomposed and rendered soluble by the employment of sulphuric or muriatic acid. Having converted the phosphates into a soluble condition, or having obtained a solution of the phosphates of alumina, they may either be employed in their concentrated form, or a solution of the same may be diluted, and they are then in a fit and proper condition to be employed for the treatment of sewage. Whilst the sewage is contained in a cistern or reservoir, or whilst it is in the act of flowing thereinto, the requisite proportion of the soluble phosphates of alumina is to be added thereto, and after thorough admixture with the sewage by the use of agitators, or other well-known means, the sewage so treated may be allowed to remain tranquil in the reservoir in order that subsidence of the resulting precipitate may be effected, or after having added to the sewage the requisite amount of the soluble phosphate of alumina, lime (by preference in the form of milk of lime) is to be added in such quantity as that the phosphates in solution shall be precipitated. This result will be known by the sewage acquiring a neutral or alkaline reaction, or the lime may be first added, and the solution of the phosphates of alumina added subsequently, but we prefer the former process, or the soluble phosphates of alumina may be first decomposed by means of lime or carbonate of lime, and the resulting precipitate may be employed for the purpose of effecting the separation of certain constituents of sewage.

"In conjunction with any of the before-mentioned methods of carrying out our invention, deodorizing agents, such for example, as animal or vegetable charcoal, may be employed, but good results will be obtained by the employment of the phosphates of alumina alone, or in conjunction with lime as before mentioned. The sewage, after treatment by either of the before-mentioned processess, is allowed to settle, and the clear or supernatant water may be run off, and the deposit or precipitate collected and removed, and employed for agricultural purposes either in the moist condition, or after having been submitted to a drying or desiccating process. Or the precipitated phosphates may be again submitted to the action of sulphuric acid, and the solution be again employed for the treatment of sewage in a manner similar to that before described. The proportions in which the soluble phosphates of alumina may be employed will vary with the sewage to be operated upon, and the quality of the manure desired to be obtained. We have obtained good results by the employment of about two parts by weight of the soluble phosphates of alumina to every one thousand parts by weight of sewage treated, but we do not limit ourselves to such proportions."

Our experiments with London and Coventry sewage, in which we added 33 grains per gallon of the phosphatic material (=10.33 grains of phosphoric acid, dissolved in its own weight of commercial sulphuric acid, gave results as follows: —

	Matters in solution.				Matters in suspension.			
London.	Total solids.	Phosphoric acid.	Ammonia.	Oxygen required.	Total solids.	Organic.	Mineral.	Phosphorio acid.
Raw sew'e.	68.33	0.64	6.33	2.54	47.42	27.51	19.33	0.68
Effluent...	100.07	0.68	5.70	1.44	0	0	0	0
Coventry.								
Raw sew'e.	46.61	0.53	1.16	0.78	21.11	8.87	11.96	0.28
Effluent...	82.59	0.60	1.04	0.47	0	0	0	0

The dried precipitate gave as follows: —

	London sewage.	Coventry sewage.
Organic matter	24.80	10.40
Phosphate of lime	16.82	22.11
Carbonate of lime and magnesia	49.39	58.14
Silica, etc., ...	8.99	9.34
	100.00	100.00
Nitrogen equal to ammonia	1.41	0.91

The effluent was clear and without smell, much soluble organic matter being removed. The process, however, is peculiar in this respect, that if no lime be added after the precipitating material, much soluble phosphate will remain in solution. The effluent may then be used for irrigation, no nuisance being likely to result from the use of the clarified water, the manurial value of which will be considerable. In other words, we strengthen (the patentees would say) the manurial value of the sewage, and purify it by the same operation.

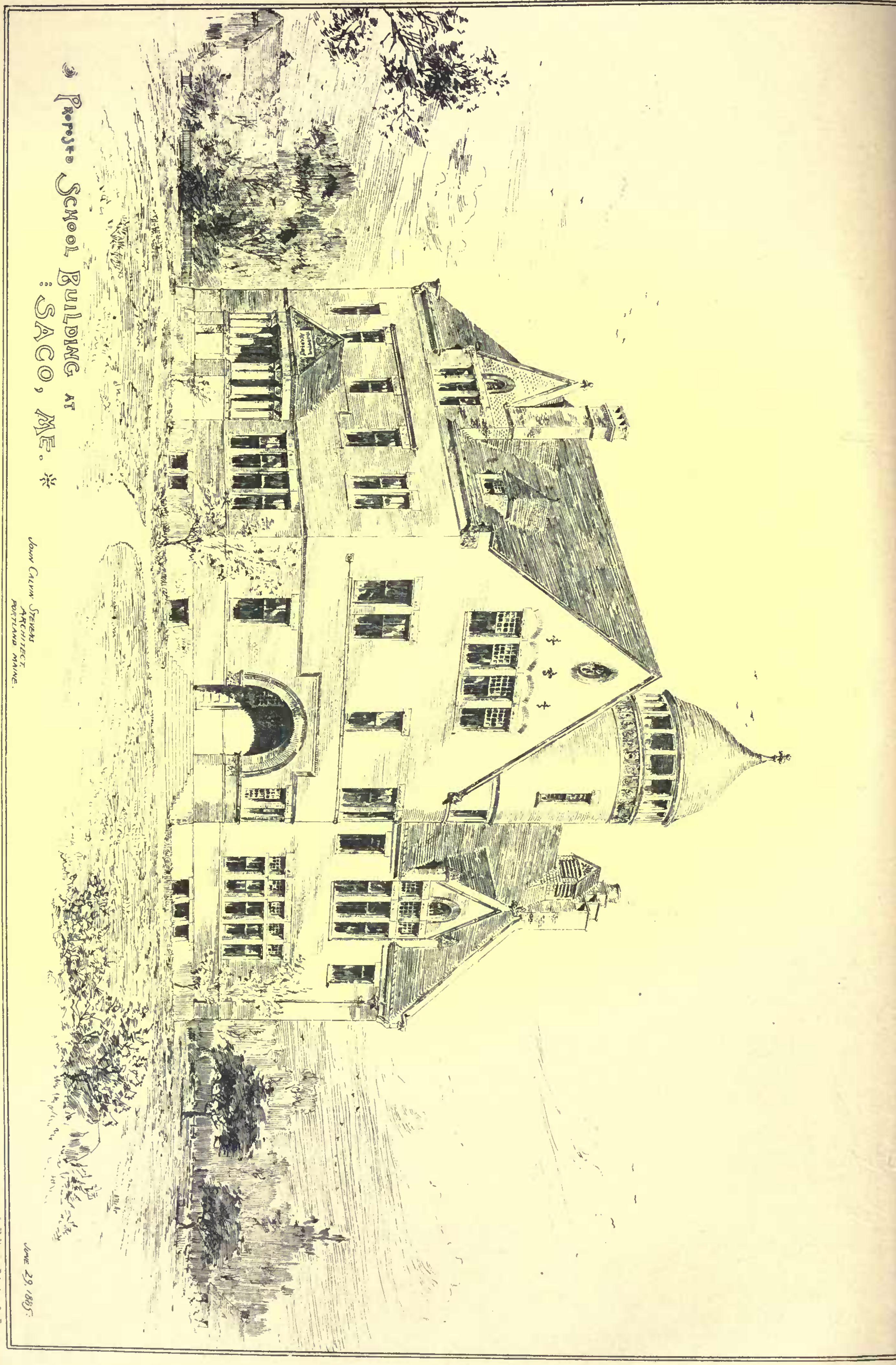
If lime be used, the deposit may be made to contain any proportion of phosphate of lime (indeed it may be rendered almost pure bone earth) necessary to pay its cost of carriage to a distance. Thus, to effect a good sanitary result, a small quantity only of precipitating matter is required, whilst a commercial success may be effected by the use of a large quantity of the precipitant. Thus, if two tons of the phosphate be added to every 1,000,000 gallons of London sewage, it would yield four or five tons of manure, containing 15 to 18 per cent of phosphoric acid, whilst if three tons be added per 1,000,000, a manure would be obtained worth, according to Voelcker, £7 7*s.* per ton, and having a composition as follows: —

	Per cent.	
Moisture	3.98	
Organic matters	20.11	
Phosphoric acid	28.52	= 62.26 tribasic phospheric of lime.
Lime	13.09	
Alumina, etc., ...	29.95	
Sand, etc., ...	4.35	
	100.	

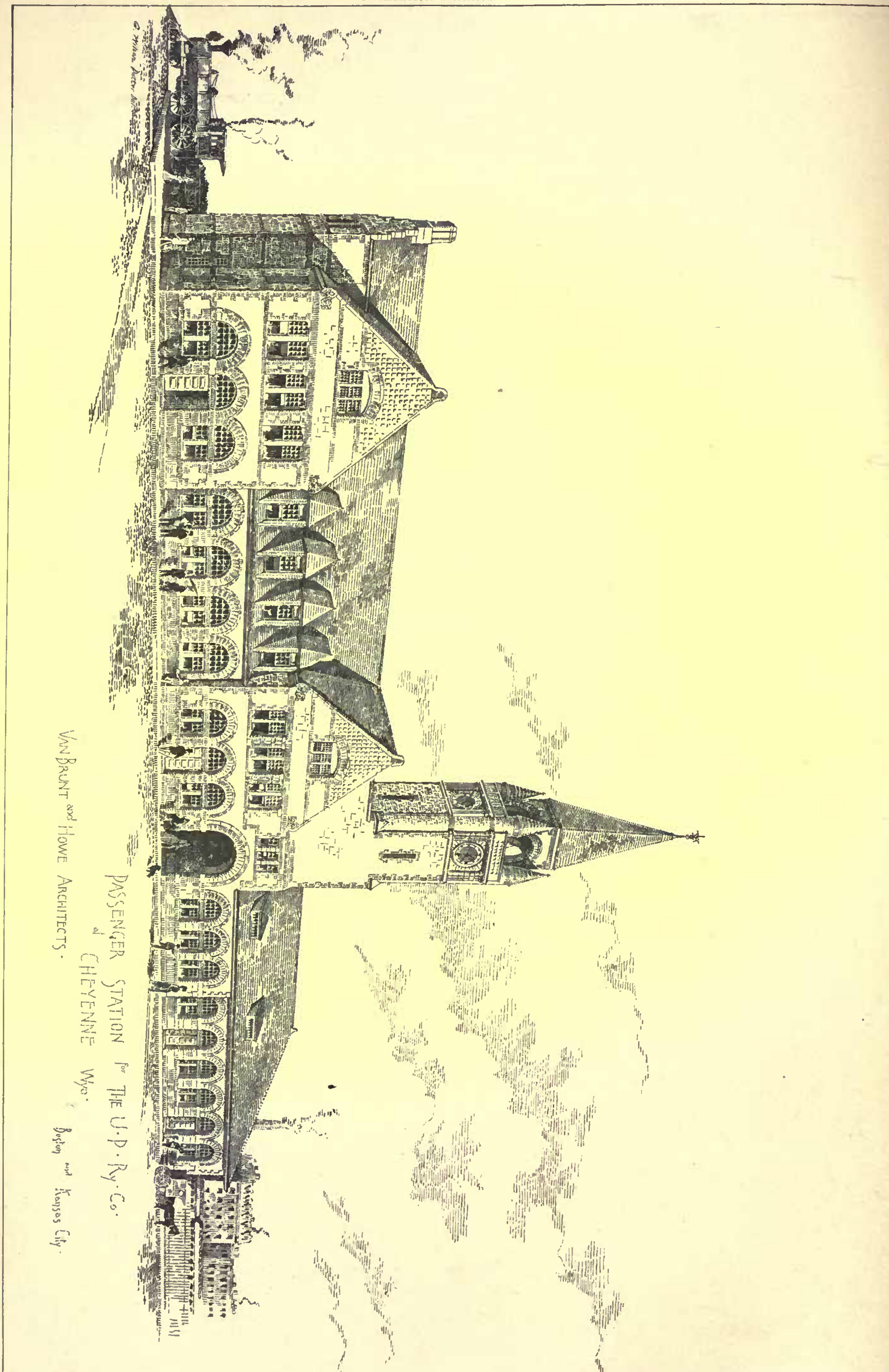
Nitrogen 0.57 = to ammonia 0.69.

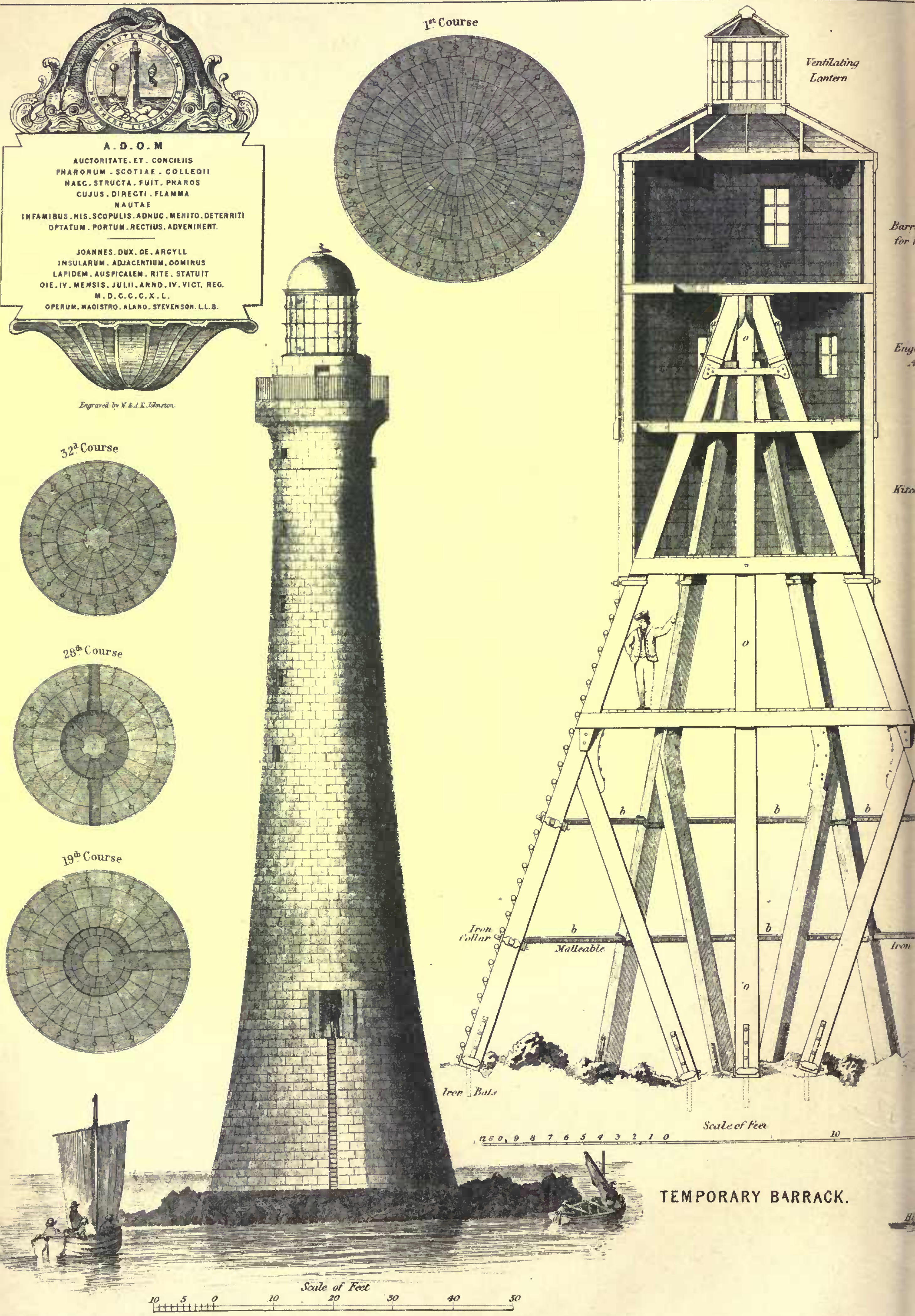
The only place where the process was worked to which we need refer is *Hertford*, where the process was in operation for two years (1876–1877). The results were good, but no details are given as to cost.

No. 576 American Architect and Building News, Jan. 8 1887.



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OPTATUM.PORTUM.RECTIUS.ADVENIENT.
JOANNES.DUX.DE.ARGYLL
INSULARUM.ADJACENTIUM.DOMINUS
LAPIDEM.AUSPICALEM.RITE.STATUIT
DIE.IV.MENSIS.JULII.ANNO.IV.VICT.REG.
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OPERUM.MAGISTRO.ALANO.STEVENSON.LL.B.
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Engraved by W. & A. K. Johnston.
1st Course
32d Course
28th Course
19th Course
Ventilating Lantern
Iron Collar
Malleable
Iron Bolts
b
Scale of Feet
10 5 0 10 20 30 40 50
TEMPORARY BARRACK.

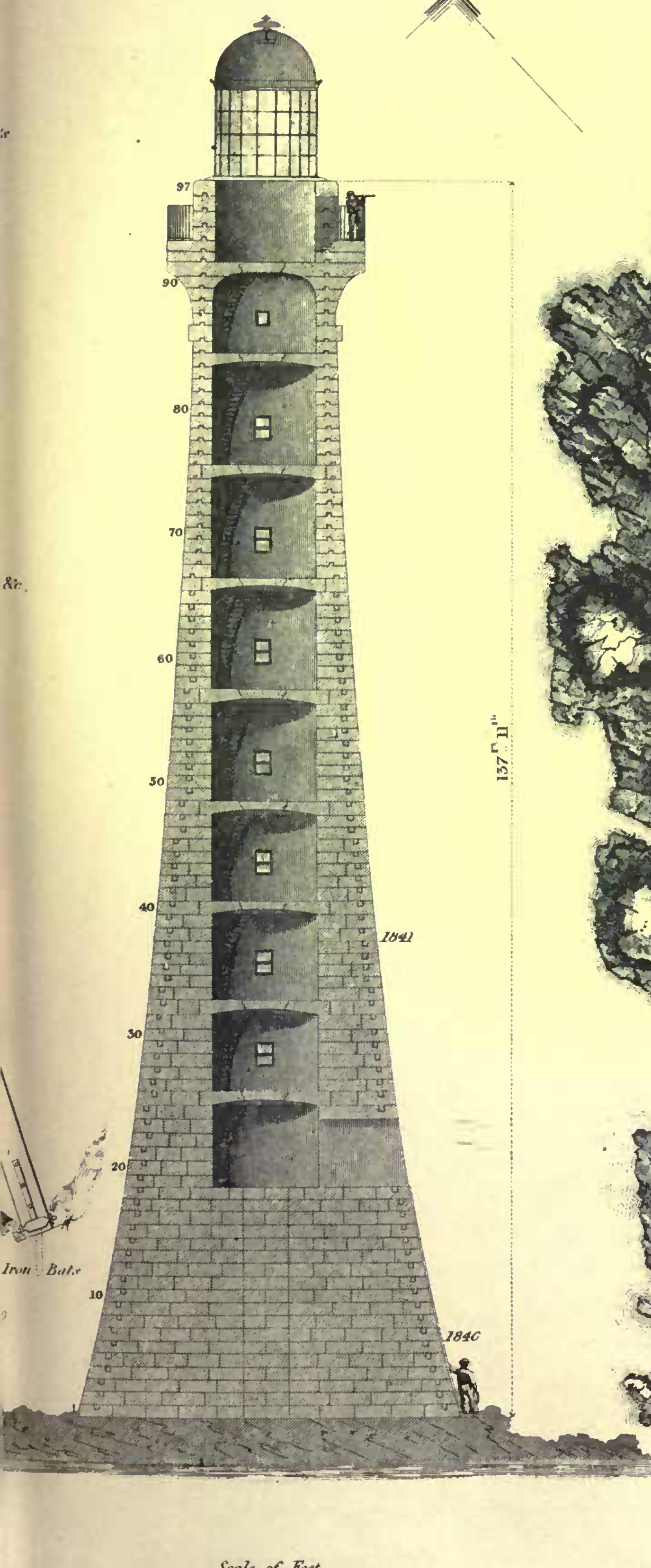


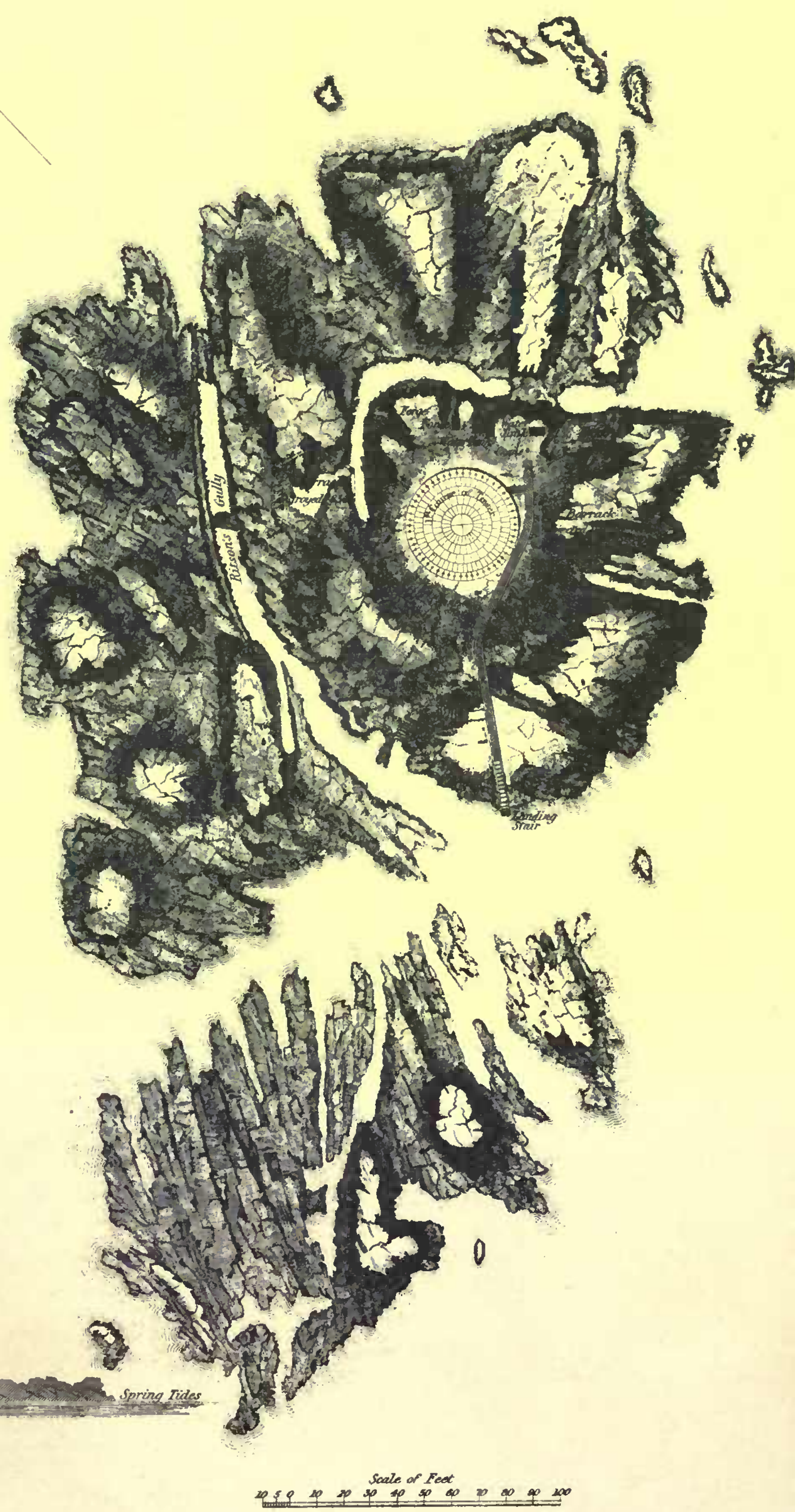


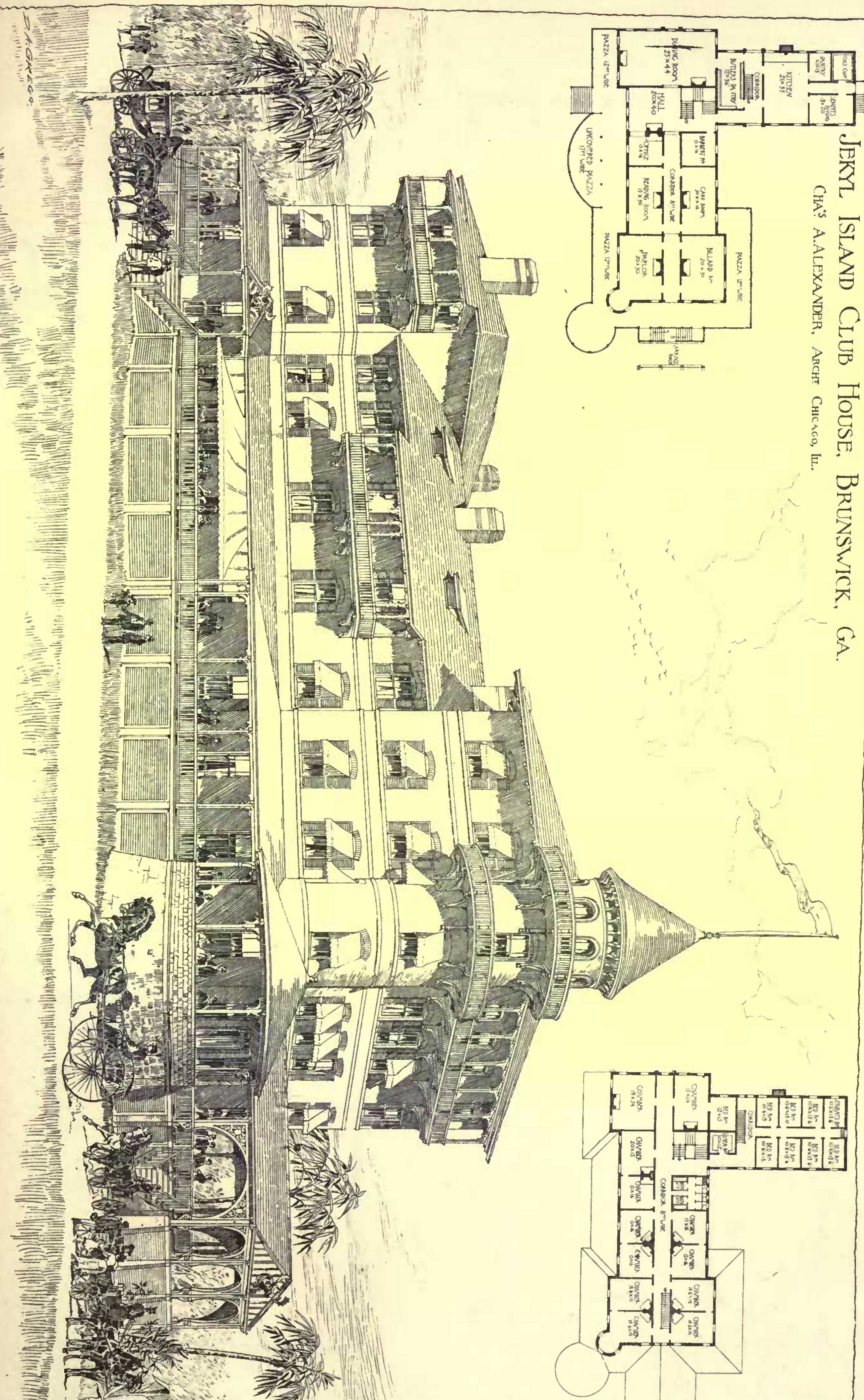
PLAN OF SKERRYVORE ROCK

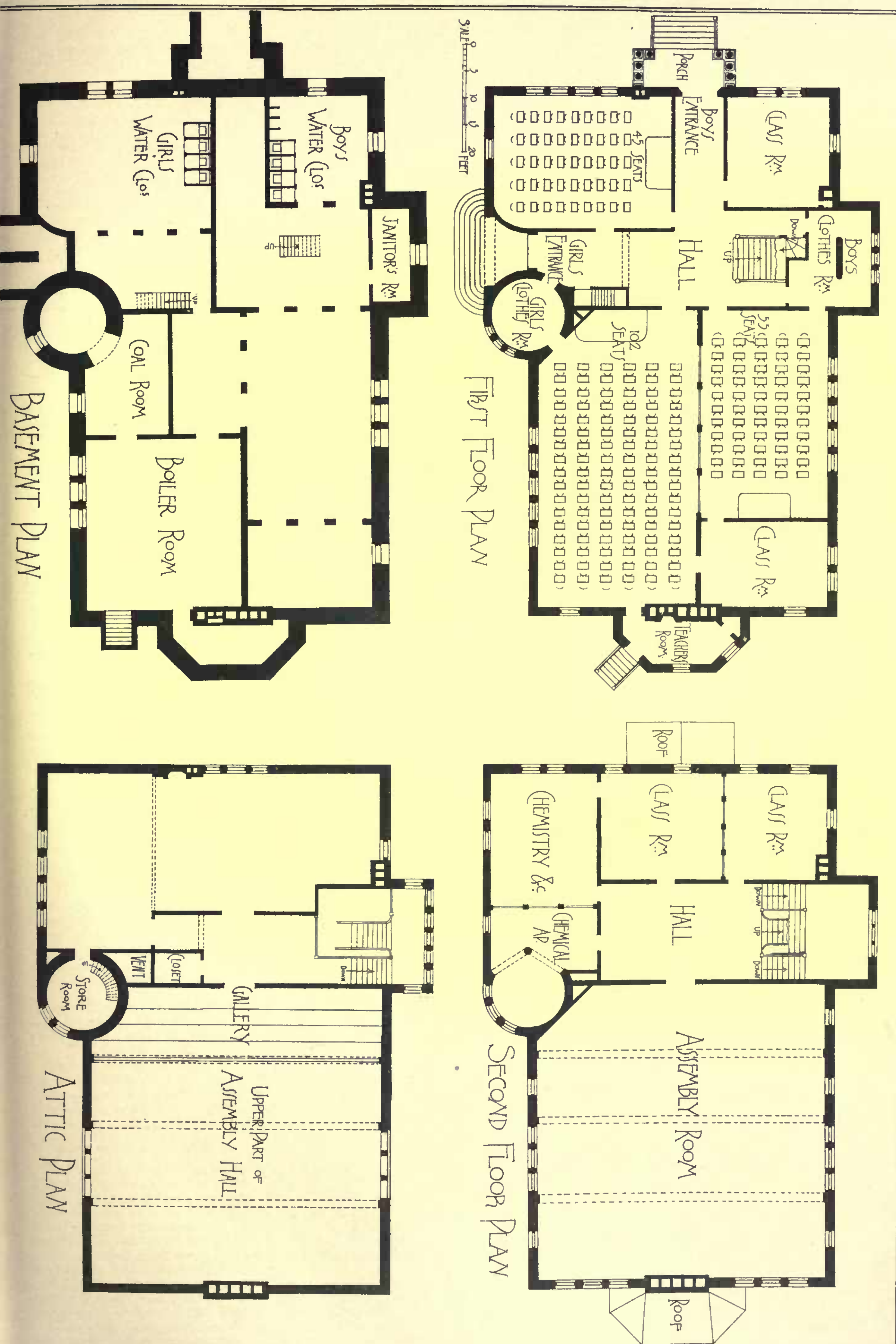
AT LOW WATER OF SPRING TIDES.

Shewing the site of the Lighthouse Tower, Barracks, Cranes, fresh Water Tanks, Railway &c.






Jekyl Island Club House, Brunswick, Ga.
Cha's A. Alexander, Arch't Chicago, Ill.


Basement Plan
Girls Water Clos
Boys Water Clos
Janitor's Rm
Coal Room
Boiler Room
First Floor Plan
Porch
Boys Entrance
Class Rm
45 Seats
Girls Entrance
Hall
Boys Clothes Rm
Girls Clothes Rm
102 Seats
53 Seats
Class Rm
Teachers Room
Scale
Feet
Attic Plan
Store Room
Vent
Closet
Gallery
Upper Part of Assembly Hall
Second Floor Plan
Roof
Class Rm
Class Rm
Chemistry &c
Chemical Ap
Hall
Assembly Room
Roof

The company paid £100 per year rent for the works, and received £300 per year as a subsidy from the corporation, *i. e.*, at the rate of 7*d*. per head of the population.

Whitthread's Process (1872). — The patentee employs superphosphate with a little milk of lime, the object being to recover the phosphoric acid in the sludge.

It was used at the following places: —

Romford Sewage Farm. — Tried by Colonel Hope, and mentioned by him with approval, in 1872, at the Social Science Congress.

Luton (*Bedfordshire*). — Used in 1874. Not successful.

Enfield (1874). — Was considered successful, but abandoned on the ground of cost.

Tottenham (1874). — 18 cwt. of chemicals was added per 1,000,000 gallons, at a cost of £3 2*s*. The sludge was dried, its value being estimated at £4 3*s*. 6*d*. per ton, the cost of production being £3 8*s*. 9*d*. The purity of the effluent was questioned, owing to the quantity of phosphoric acid in solution. The process was soon abandoned, owing to the liquidation of the company.

Dugald Campbell's Process (1872). — The patentee employs superphosphate and some lime. It was tried in Tottenham in 1872, for six days on 3,500,000 gallons, at a cost for chemicals of £16 6*s*. 5*d*. per 1,000,000 gallons, yielding 6.3 tons of manure per million, valued at £5 per ton.

It was also tried experimentally (1873 to 1875) on the metropolitan sewage, when the chemicals required to produce a good effluent were found to cost at the rate of £22 6*s*. per million gallons. The dry manure was valued at from £4 15*s*. to £5 15*s*. per ton.

SALTS OF IRON.

Brown (February, 1847) patented the use of the sulphates and chlorides of iron as sewage disinfectants, and *Ellerman* (October, 1847) the use of the chlorides and pyrolynates (acetates of iron). Ellerman's fluid (price 1*s*. 6*d*. a quart retail, 9*d*. wholesale) contained from 24 to 43 per cent of the iron salts named, and had a specific gravity of from 1336 to 1443. There was some division of opinion respecting its value, Letheby reporting that 100 grains of Burnett's fluid (sp. gr. 1594) had an equal deodorizing power to 470 grains of Ellerman's fluid (sp. gr. 1443), a view supported by Mr. Haywood and others.

Dale's Fluid (sp. gr. 1450, price 6*d*. per gallon) was a strong solution of perchloride of iron, and was proposed by Hofmann, Frankland and Miller, for deodorizing the Thames during the hot summers of 1857 and 1860, on the ground that it compared favorably, as regards cost, with lime or chloride of lime. Thus they said 1,000,000 gallons of London sewage required for deodorization the following quantities of the several ingredients named: —

	Cost. £	s.	d.
86 gallons of Dale's fluid	1	13	0
400 lbs. of chloride of lime	2	2	10½
132½ bushels of lime	3	6	6

They remarked that the sewage treated with lime became offensive after three days — with chloride of lime after four days — whilst that treated with perchloride of iron did not become offensive even after nine days. The use, however, of the iron was objected to by Odling and Letheby, both urging that a black mud would form in the river, which, after a time, would undergo putrefactive changes, and be more unsightly than even the sewage. Letheby also urged the quantity of a senic in the perchloride as an unanswerable objection to its employment as a precipitant where the sludge is not removed before the treated sewage is allowed to escape into the river.

Dale's liquid (130 gallons to 1,000,000) was used at Croydon in 1852 and 1860. The results were not satisfactory, because the suspended matter was imperfectly removed, the iron sulphide giving the effluent a black and polluted appearance.

Dover's patent (1851) claims the use of acids with iron filings or oxide of iron and protosulphate of iron, the defecated sewage being afterwards filtered through charcoal, peat, etc.

Mudie's disinfectant, a preparation of dry copperas, is valuable for the deodorization of drains, etc., owing to its property of absorbing ammonia and sulphuretted hydrogen. It is hardly suited for the defecation of sewage, although it acts well as a general disinfectant, for which purpose it is largely used in the French slaughter-houses.

LIME, SULPHATE OF IRON, AND COAL-DUST.—HOLDEN'S PROCESS.

This mixture, as a sewage precipitant, was patented by Jules Houzeau and Devedeix (1866), and was used at Bradford by Mr. Holden (hence known as *Holden's process*). The sulphate of iron was to be added first, and afterwards milk of lime mixed with coal-dust. The use of clay is also mentioned in Holden's patent. The treated sewage then flows into subsiding tanks. A clear and inodorous effluent can be obtained, about one-half of the dissolved organic matter being precipitated. The manure is of little value.

Bradford. — The process was tried in 1868, on 130,000 gallons daily. It was reported against by the Rivers Pollution Commissioners, as giving a clear effluent, but of a quality worse than the original sewage, founding their opinion on the quantity of organic nitrogen present. They supposed that the putrescible organic matters in suspension passed into solution by this treatment. Further, they considered the hardness of the effluent an objection to its being allowed to pass into water-courses.

Marsden and Collins's Process consists in the use of lime, carbon-waste from the prussiate manufacture, house-ashes, soda, and perchloride of iron.

This process was used in 1874, at *Bolton*, in dealing with one-sixth of the sewage (population, 93,000). The cost of chemicals was given at £1 7*s*. 3*d*. per million gallons of sewage, the total cost being £7 14*s*. 5*d*. per million.

Hanson's Process (1875) employs lime, black ash (tank waste, or refuse from alkali works, containing sulphides of calcium and sodium), and red hæmatite treated with sulphuric acid.

This process was tried at Leeds, the chemicals used being in the proportion of

	Tons.	Cwts.
Lime	20	0
Black ash	4	0
Red hæmatite and oil of vitriol	1	6

Two tons, 16 cwt. and 1 qr. were added to every 1,000,000 gallons, at a cost of £2 5*s*. 8*d* per million. The effluent was said to be good. Its use was discontinued in April, 1876.

A modification of this process is now in use at Leyton. The process was adopted in 1882 by the Golcar Local Board.

Goodall's Process (1875) employs lime, animal charcoal, ashes, and iron liquor (solution of sulphate of iron). It was claimed that the cost would be 7*s*. 6*d*. per million gallons (Leed's Clarifying and Utilization of Sewage Company).

Leeds. — The process was tried at Leeds. Tried for three months in 1875. The chemicals were mixed in the following proportions:

	Tons.	Cwts.
Lime	21	15
Carbon	13	15
Ashes	10	14
Iron liquor	—	4

Five tons 3 cwt. of this mixture were added per 1,000,000 gallons, at a cost for chemicals of £2 4*s*. per million gallons.

Newcastle-under-Lyme (population 18,000; 700,000 gallons daily). This process was adopted between 1877 and 1881. In 1881, 30 acres of land was secured, 10 only being employed for irrigation. There are four precipitation-tanks, 125 ft. x 25 ft., and 4 ft. deep; cost, £1,100 per annum.

LIME AND AN IRON SALT.

At Ealing the lime (20 cwt. per week to 3,000,000 gallons) is added to the sewage in course of its transit to the subsidence-tanks. These tanks, each measuring 64 ft. x 10 ft. x 10 ft. deep, are divided into five compartments by cross planks, where the lime precipitate subsides. In the last sub-division of the tanks, the defecated sewage is treated with an iron solution (crude sulphate 15 cwt. to 3,000,000 weekly). The sewage then flows upwards through two filter-beds (No. 1, gravel, 30 ft. x 10 ft. x 2 ft. thick; No. 2, sand, 60 ft. x 10 ft. x 2 ft. thick), the effluent being clear and inoffensive when discharged.

At Northampton, in 1862, lime (as milk of lime) and chloride of iron (in solution) were used as sewage precipitants. The constituents were mixed together, and so decomposed, before they were added to the sewage (60 lbs. of solid chloride of iron, 12 bushels of lime to 400,000 gallons of sewage daily). There was no mechanical contrivance to mix the sewage with the chemicals. The sewage after treatment passed into two subsiding-tanks (40 ft. x 30 ft. and 60 ft. x 30 ft., each 5 ft. deep) from the second of which it flowed over a weir into an outfall channel a mile in length, being ultimately discharged into the River Nene. The tanks were worked for a fortnight, when the sludge was conveyed into pits, and mixed with the town refuse, the manure realizing 1*s* 9*d* per load.

Letheby recommended adding the iron salt to the sewage first and the lime afterwards, and that some mechanical contrivance for stirring the treated sewage both after the addition of the iron and the lime should be adopted. He considered 4.5 grains of chloride of iron and 15 grains of lime per gallon were needed. These details were adopted and the results obtained were excellent.

Some difficulty having occurred in procuring the chloride of iron, a solution was prepared on the works of 9.400 grains per gallon. A fit of economy then led the authorities to reduce the quantity to 0.006 grain of chloride of iron, and 5.88 grains of lime per gallon, quantities manifestly insufficient, under which treatment it was seen and reported on by the Rivers Pollution Commissioners.

For a short period combinations of lime and salts of iron were used both at Clifton and Cheltenham.

Having now dealt with the various precipitants suggested, to throw down the suspended matter and coagulate a part of the dissolved slimy organic matter of sewage, let me note that these precipitants, for practical purposes, are lime, chloride of magnesium, sulphate and phosphate of alumina, and salts of iron, alone or in conjunction with each other. In addition to these, clay and other weighing bodies, together with charcoal and other absorbent substances, have been added under various patents.

In selecting a chemical precipitant, five main points present them selves to us:

1. That, consistently with purity of effluent, the chemicals used should be cheap.
2. That the presipitant should act as a deodorizer and disinfectant as well as a precipitant.
3. That the precipitated matters should subside rapidly.
4. That the maximum purity should be obtained with the minimum of deposit, in other words, with the smallest quantity possible of chemicals.
5. That the sludge should part with its water readily.

[To be continued.]

The ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE GARDNER HOUSE, PLEASANT STREET, DORCHESTER, MASS.

[Gelatine Print, issued only with the Imperial Edition.]

THE date of the erection of the original portion of this house is lost in obscurity. The central part is undoubtedly two hundred years old. By going into the cellar one can now see that the timbers under the parlor floors are of hard wood (mainly black ash and oak) with the bark still on, while the upper side has been chamfered off with a broad-axe, indicating its erection before the existence of saw-mills. A grove of black-ash trees stood a little north of the house, one or two fine specimens of which still remain, from which it is inferred the trees of which its frame is composed grew upon or near the spot where the building now stands.

Dr. Henry Gardner purchased the estate near the close of the past century, and he added to the structure in every direction. He built the swell ends or "bows" as seen in the plate. He also increased its height by a half-story, erected the dining-room in the rear and built the south-west portion over the well which originally was dug outside the house. In these various repairs and additions, some of which were made within the memory of the writer, the framework was exposed, and found to be of immense timbers of oak and ash. The nails were all hand-wrought ones; its hinges mainly of the HL pattern; its locks were of brass screwed to the inside of the doors, and the finish was in panels, some of them three feet wide, from a single piece of pine, with hand-carved pine mouldings.

Like all houses erected so long ago, the ceilings were low originally, probably not exceeding seven feet in height. Some half-century ago, however, Dr. Gardner sunk the floors of the parlors, thereby making these rooms a foot higher. The earliest-known occupant of the house, about the time of the Revolutionary War, was one Bird, and probably the original structure was erected by his ancestor a century before. After him the house was inhabited by Mr. Thomas Niles, an ancestor of the present owners of "Niles Building;" subsequently Dr. Gardner purchased it, and he and his descendants lived in it till the encroachment of undesirable buildings drove them away. The house has been neglected of late years, and probably before long will be demolished to make room for new structures.

PROPOSED ACADEMY AND HIGH-SCHOOL, SACO, ME. MR. JOHN CALVIN STEVENS, ARCHITECT, PORTLAND, ME.

THIS design was submitted to Saco City Government, and by them accepted for a proposed academy and high-school. It was proposed that the city should erect the building, and that the "Trustees of Thornton Academy Fund" should have charge of the running of the school. It was to have been built of brick and Longmeadow stone, and cost, complete, $35,000. Owing to some disagreement between the Trustees and City, the erection of the building has been postponed, but it will probably be put up next year.

SKERRYVORE LIGHT-HOUSE, OFF THE COAST OF SCOTLAND.

FOR description see article elsewhere in this issue.

UNION PACIFIC RAILROAD STATION, CHEYENNE, WYO. T. MESSRS. VAN BRUNT & HOWE, ARCHITECTS, BOSTON, MASS.

JEKYL ISLAND CLUB-HOUSE, BRUNSWICK, GA. MR. CHARLES A. ALEXANDER, ARCHITECT, CHICAGO, ILL.

THE SOURCES OF THE LONDON WATER-SUPPLY. — London is at present supplied with water from the rivers Thames and Lea, and from certain springs in the valleys of the Thames and Lea, supplemented by Chadwell springs, and from eleven wells in the north of London, and ten wells in the south of London, all down to the chalk. The proportions from each of these sources for the month of October, 1886, were nearly as follows: From the river Thames and certain chalk springs in the Thames Valley, about fifty-two parts of the whole; from the river Lea and certain chalk springs in the Lea Valley, about thirty-six parts of the whole; from the eleven chalk wells in the north of London, about five parts of the whole; from the ten chalk wells in the south of London, about seven parts of the whole. — *N. Y. Evening Post.*

ASYLUM PLANNING.[1]



FROM REVOIL.

I AM strongly of opinion that for large public asylums (say 600 beds and upwards) the separate block system is far superior to any other. As the most excellent and recent examples of this may be mentioned the new county asylums at Cane Hill (Surrey) and at Gloucester; also, though not quite so recent, the Middlesex County Asylum, at Banstead. For smaller asylums, however, the separate pavilion system is too expensive both in construction and administration for adoption by public bodies; the special circumstances, moreover, which render its adoption so desirable in the case of very large asylums are not present in the same degree in smaller institutions.

It is believed that the plan now submitted combines most of the advantages of the block system with the convenience of the old succession of gallery wards, and that it avoids the chief disadvantages of each. In the block system each pavilion is surrounded on all sides by fresh air, thus affording special facility for lighting and ventilation, also great variety of aspect and prospect. In the present plan each ward is open to the air on both sides, being lighted and ventilated by windows throughout its length. The buildings to the north of the wards, moreover, being but one story in height, there is practically no obstruction to the access of light and air from that side. As in the block system, some of the windows must overlook other parts of the asylum building, but every ward commands uninterrupted views of the surrounding country from many of the windows. In the block system each ward is a complete administrative unit shut off from the rest of the asylum; the attendant in charge of it can, therefore, be held responsible for everything occurring within it, for he is not subject to interference by other persons passing through on their way to or from other parts of the building. The present plan possesses this advantage in the fullest degree, each ward having a separate and independent entrance from the general system of corridors, so that through traffic is unnecessary and may be forbidden to all except the superior inspecting officials. In the present plan, as in the block system, each ward is complete in itself, containing, in addition to living and sleeping accommodation, lavatories, store-rooms and attendant's rooms, with baths, single rooms, sculleries, etc., wherever they are required.

The chief excellence of the old corridor plan (successive strings of gallery wards) lies in the facility it affords for medical and other supervision by reason of the easy communication from ward to ward. In the present plan this is fully provided for on both upper and lower floors, the supervising officer being able to pass through the whole range of wards without once retracing his steps. The doors of communication are also most valuable as alternative exits in case of fire or panic. On the upper floor they afford access to additional staircases. The chief disadvantage of the separate pavilion system, from an administrative point of view (to say nothing of the excessive original cost in small asylums), arises from the loss of time experienced in "going round the wards," owing to the necessary retracing of steps. When the upper floors of the blocks are visited each staircase has to be separately ascended and descended, a length of corridor being also traversed between each block. All this is avoided, as has already been explained, in the present plan. As a general rule, in the block system there is but one means of exit from the upper floors, and this is apt to be cut off in case of fire; no such danger exists in the present design. In the block system the wards are so isolated that there must necessarily be some delay in obtaining help from adjoining wards in cases of emergency. No such delay would occur in an asylum constructed upon the plan now proposed; this is specially important in small asylums where, the wards being small, the attendants in each are necessarily few. The most marked defect of the old system of construction, where gallery wards open one into another, arises from the almost incessant passing of traffic through the wards. This disturbing influence interferes with the comfort and temper of both patients and attendants; it destroys all feeling of homeliness and coziness, leads to disagreements among the staff, and prevents attendants from taking that pride in the appearance of their ward which conduces so much to the happiness and recovery of the inmates. It should be noted that this last objection holds good with almost increased force in the case of some asylums which are professedly constructed upon the block system. In the buildings to which I refer the corridors which connect one block with another take the form of gallery wards, which, being small, are usually occupied by recent and refractory cases. The very patients whom it is most necessary to withdraw from all disturbing influences are thus unduly subjected to them. This system of construction is advocated on the ground that great waste of space and building material is avoided by utilizing corridors of communication as wards.

[1] From a paper by C. S. W. Cobbold, M.D., contributed to the *Journal of Mental Science* for January last.

It must, however, be borne in mind that a gallery ward is far more expensive to construct than a simple covered way; also, that one of the great advantages of the block system (complete isolation of each block) is counteracted if the pavilions be connected together by wards, thus allowing an interchange of vitiated atmosphere such as cannot occur if only covered ways with free cross ventilation are interposed between the blocks. Various plans have been devised with the object of avoiding the evils of traffic passing through the wards. That most generally adopted is the placing of a covered passage beside each ground-floor ward beneath the sills of the single room windows. This mode of meeting the difficulty is the best practicable in many gallery-ward asylums, but it is objectionable, and usually results in the provision of a cramped, low, ill-ventilated passage, at the expense of the proper lighting and ventilation of the ward upon which it abuts. In the plan now submitted, each ward has a separate approach through well-lighted and ventilated passages; but these latter are very economically provided, being, for the most part, placed under the same roof with various parts of the administrative buildings, to which they serve as means of approach and passages of communication.

The present design may be briefly described as follows: Facing the north is the main entrance; upon one side of it is the medical superintendent's residence, and upon the other the committee rooms and clerk's office, with separate accommodation over for the assistant medical officer, matron, etc. Running directly backwards from this block are administrative buildings in the following order: Steward's stores, engine-house, boiler-house, coal store and bakery, all surrounding the stores' yard. Next follows the kitchen department, consisting of main kitchen, scullery, larder, pantry, two mess-rooms for attendants, and a good meat store well placed in the centre of an open court. Immediately south of the kitchen, and separated from it by a cross-corridor, is the large dining and recreation hall, which thus forms the centre of the south front, and is conveniently placed both for the serving of meals from the kitchen and for the access to patients from the male and female departments independently. The hall is capable of seating about six hundred persons, and is fitted with a raised stage and dressing-rooms. Additional exit doors, communicating through side lobbies directly with the open air, are provided in case of need. From this hall, as a central feature, the male wards run eastward and the female wards westward, all of them facing the south. The wards run in a straight line for only half their length; they are then canted to the north-east and north-west respectively at an angle of forty-five degrees. This has the effect of bringing the more distant wards much nearer to the central administrative departments, thus producing compactness and avoiding useless lengths of communicating corridor, while, at the same time preserving to each ward a large element of southern aspect, and providing an increased range of view from the windows. This arrangement also removes, to some extent, from the general patients' front those wards which are intended to accommodate the most noisy and refractory cases. Another subsidiary advantage is that a good view of the asylum-front can thus be obtained from many more points of the compass than would be the case if the frontage were all in one line.

The wards are nowhere more than two stories high; they provide suitable accommodation for four distinct classes of patients of each sex, and comprise in each department: (1) The infirmary for sick and bed-ridden; (2) a ward for recent and convalescent cases; (3) the chronic ward for working and quiet patients; and (4) the epileptic and refractory ward with observation dormitory for suicides and epileptics. On the female side a separate ward for twenty-five laundry workers is also provided, thus supplying the excess of accommodation which is always required for females in public asylums. In planning an asylum for a larger number of inmates a greater variety of accommodation would, of course, be provided; the refractory might be separated from the epileptic, the recent from the convalescent, the workers from the harmless idlers, and so forth; but nine separate wards is a liberal allowance for a pauper asylum with only 300 beds, and it is believed that an experienced superintendent could so utilize the accommodation now suggested as to effect a perfectly satisfactory classification of his patients. The infirmary ward is in form a combination of a gallery ward with an ordinary rectangular hospital ward; it is placed upon the ground floor next to the central hall, and is, therefore, most conveniently placed for access by the medical and other officers. It contains twenty beds (including three single rooms), a day-room, with a large bay-window, separate kitchen, store-room, attendant's-room, bath-room (with movable bath), water-closets, lavatories, slop-sink, etc. A veranda upon the south front has a door opening directly into it, and is fitted with sun-blinds, which would be removed in winter so as not to interfere with the access of light and air.

The reception or convalescent ward is placed upon the floor above the infirmary, to which it is somewhat similar in shape, but it contains more single rooms and a more spacious day-room. This ward is also capable of further sub-division by means of a dwarf glazed screen placed across it. The chronic ward is intended to accommodate seventy-five patients; it consists mainly of a large day-room upon the ground floor and associated dormitories above. The spacious day-room has a large bay-window in the south front and, owing to its canted line of axis, commands from its windows a great variety of aspect and view. The patients for whom this ward is intended do not require such constant immediate supervision as is necessary in the other wards; they are also prone to form cliques and coteries, each of which likes to appropriate a table or corner in the ward to its own more immediate use. The somewhat irregular shape of the day-room readily lends itself to such arrangements, which are really advantageous in that they allow each patient to "choose his own society" and thus avoid quarrels arising from the forced association of uncongenial temperaments. Independent water-closets and lavatories are placed in this, as in all the wards upon each floor. Suitable stores for coals and clothing are also provided. The dormitories for this ward extend over the day-rooms of both this and the adjoining epileptic ward; rooms are provided for three attendants, and alternative staircases afford free exit in case of fire. The ward for epileptics is confined entirely to the ground floor, and is arranged for thirty patients with rooms for four attendants. The day-room is lighted from both sides and posesses a large bay-window, a scullery, and a store-cupboard. The observation dormitory for twenty-four beds opens directly out of the day-room; it also is lighted on both sides, and has at its farther end a range of eight single and padded rooms; in these latter the beds would be constructed to lock down in position upon the floor. The water-closet, bath, and lavatory pavilion is so placed and arranged that it can be made accessible from either the day-room or the dormitory, or can be locked off from either. A room for two attendants is so placed as to overlook both the dormitory and the day-room. One of the baths would be movable, so as to be capable of being conveyed to the bedside of a patient. The single rooms are lighted through thick glass by gas-burners placed outside the rooms, and the doors would be fitted with narrow open panels to allow of constant supervision.

The centrally-placed stores and kitchen departments are flanked by two central corridors, running north and south. Branching off from these at right angles are the east and west corridors which lead to the epileptic and chronic wards. Upon these lateral corridors are situated, on the male side, a range of spacious work-shops and the general bath-house, with dressing-room, lavatory, and water-closet; on the female side, the laundry, laundry-yard, sewing-room, general bath-house, etc. The workshops open off the lateral corridor; they also communicate one with another and with an enclosed goods and work yard, the opposite side of which is formed by coal stores and the smith's shop. The laundry is close to the engine-room and boiler-house, being also easily accessible from all parts of the asylum. It comprises receiving-room, wash-house, drying-closet with hot-chamber above, ironing-room, sorting and distributing-room, also a separate washhouse for foul linen, and spacious drying ground. The rain-water from all roofs is collected into tanks and made available for use in the boilers and laundry. The laundry ward is in direct connection with the laundry itself; it is calculated for twenty-five patients, the day-room being upon the ground floor, and the dormitories up-stairs. Storeroom, water-closets, lavatories, and attendants' rooms are provided in connection with this ward. Each general bath-room contains five baths, one of which is partitioned off for the attendants' use; a convenient dressing-room, with fire-place, water-closets, etc., adjoins it. The bath-houses not being connected with any ward, can be used independently by the patients from each, without giving rise to administrative friction. Convenient quarters for the chief-attendant and head-nurse are placed at the junctions of the central and lateral corridors. At the north ends of the central corridors are the side entrances for patients, visitors, and servants — male and female respectively. Close to these entrances are good male and female visiting-rooms with separate water-closet accommodation for each. Near to the patients' entrance upon the female side are the dispensary and office, which are thus conveniently near to the medical officers' quarters.

The detached chapel, designed to seat three hundred and twenty persons, is placed near to the patients' entrance upon the male side; it is provided with separate entrances for the sexes, and with waiting-rooms adjoining the lobbies as required by the commissioners. I am personally strongly in favor of having asylum chapels in direct communication with the main building, or forming a part of it, thus differing from some high authorities. I know by experience that detached chapels are not used so frequently nor by so large a proportion of patients as those which are attached. Many causes combine to bring about this result. Attendance at a detached building necessitates out-door clothing, and a larger staff of attendants to supervise the patients in going to and fro. In inclement weather several things may happen; either a very small congregation attends, or a large number of patients get their clothes wetted (a serious matter in a pauper asylum, where change of clothing and drying accommodation must be limited, and umbrellas are unknown), or the service is hastily held in the recreation hall with unavoidable detriment to a devotional frame of mind. When the chapel is detached its use is generally restricted to Sundays and festivals, daily prayers being said in the hall. When, however, the chapel forms part of the main building, morning and evening prayers are usually held in it daily, the short, bright service, with the organ, attracting good congregations. Many runaway and troublesome patients, who would not be taken to the services in a detached building, attend them regularly in the asylum, and have no ideas of escape aroused in their minds thereby. If the chapel is used only upon Sundays it is very apt to be insufficiently heated in the winter; if used daily it is far more likely to be kept comfortably warm. The great argument in favor of a detached chapel is that it is more natural to go out to church than to have a private chapel at home, and that the patients regard

attendance at a separate building as something outside their asylum life, and prize it accordingly. I cannot attach very much weight to this argument, as it does not accord with my experience, and even during service in a detached chapel the patients are surrounded by the same officials and fellow-patients with whom they always associate. The privilege of attending a public place of worship outside the asylum is quite another thing, and is greatly appreciated by those patients to whom it can be safely accorded. In compliance with the recommendation of the Commissioners in Lunacy, the chapel in the present plan has been designed as a separate and detached building, but a covered corridor connecting the chapel with the asylum could be easily provided if thought desirable. The position of the chapel with respect to the main building might also be varied in accordance with any peculiarities of site.

The sanitary arrangements of the asylum have been most carefully planned. All water-closets (and urinals) are placed in separate pavilions, and are cut off from the wards by lobbies with cross-ventilation. They would be subjected to periodical flushing by automatic apparatus, in addition to the ordinary flushing after use. This latter is effected by a simple pull fixed in a slot in the wall and connected with an automatic flushing-cistern above. All soil-pipes would be outside the walls and be carried above the roof. The main drains are planned to run in perfectly straight lines for the longest distance possible; at every point of junction or change of direction is a proper inspection man-hole through which the drains run in open channels. No drain passes under any part of a ward or other inhabited portion of the asylum. Where it is necessary for drains to pass under the corridors of communication they are carried in straight lengths of perfectly air-tight construction. All waste-pipes from baths, sinks, lavatories, etc., discharge over open intercepting gullies; in connection with these would be fixed automatic flushing-tanks by means of which the drains would receive continually and regularly a powerful and effective flushing. The traps in connection with kitchen and scullery sinks are, in addition, specially adapted for the interception of all grease. Drains would be trapped at all proper points and would be freely and thoroughly ventilated throughout. The drainage could be discharged into a main sewer, or made available for irrigation as might be desired. Large rain-water receiving-tanks are planned at various points and are all in continuous connection. From these the water would be raised, by a lift-pump fixed in the engine-room, into a large tank over the boiler-house. From this the boiler would be supplied for laundry, heating and other purposes. The whole of the wards and administrative buildings (including corridors, bath-rooms, water-closet pavilions and workshops) are warmed by a system of circulating hot-water pipes, charged with rain-water in order to avoid the incrustation and stoppage which follow the use of hard-water for this purpose. In the wards generally the pipes are enclosed in casings constructed to form seats around the walls and bays. Fresh air is admitted through grated flues in the outer walls, it then passes over and along the hot-water pipes and afterwards enters the wards through large hit-and-miss gratings. These last are not placed opposite to the flues in the outer walls, but alternate with them. In the single rooms and other parts where it is not advisable to have the pipes in the rooms, they are laid in channels in the floors and communicate warmed fresh air to the rooms by means of appropriately-placed flues and hit-and-miss gratings. All pipes are easily accessible for examination and repair. All hit-and-miss gratings are made to lock either open or shut. Open fireplaces are also provided throughout the asylum in suitable situations, strong iron guards being always supplied. Specially-constructed windows afford a means of thorough cross-ventilation wherever desired, without exposing patients to direct currents of cold air. Additional and more permanent ventilation is afforded by the provision of flues and special construction, which lead to channels connected with four main extract shafts. In each of the latter a coil of steam-pipes is fixed, thus creating a powerful extracting force, the effect of which can be regulated in each ward by means of gratings to lock open or shut. The exhaust will also be increased by the gas-jet provided under the outlets in the ceilings of the wards, above single-room doors, etc. Thus are amply secured both the extraction of foul air and its replacement by either warmed or cold fresh air, admitted as already described.

The window-sashes to all parts of wards, and wherever accessible to the patients, are provided with locks to fasten closed or open at certain regulated heights. They are also formed with an extra wide bottom rail and closing bead on sill, thus enabling the lower sash to be raised sufficiently to form an up-current of fresh air for ventilation at the meeting-rails without opening the lower portion to admit draught. Strong simple shutters are fixed in the single rooms to work flush with face of wall both when open and shut; they are also provided with locks for fastening in either position. All windows accessible to patients throughout the asylum are protected on the outside by iron guard-bars following the lines of the glazing bars of the sashes, and securely fixed to the brickwork. This arrangement produces absolute safety, but is neither unsightly nor prison-like in appearance. When the windows are closed, the guard-bars are not seen from within. From the outside, at a little distance, the guard-bars look like the glazing bars of the sashes, and are, therefore, not specially noticeable whether the windows be open or shut.

Glazed tubular dust-shoots are formed in the walls at points convenient at each ward; they discharge into iron sifter bins, carried on wheels, and placed outside under the outlets of the shoots. These can be wheeled away when required, and empty bins substituted. The openings to these shoots are protected at the inlets by horizontal iron cross-bars, and have stout iron quadrant receivers, formed to shut flush into the wall when not in actual use, and to be so locked by the attendant. Throughout the asylum thorough provision has been made for the suitable placing of supply-pipes for gas and water, but the source of these necessaries must depend upon the special conditions and surroundings of the site. Fireproof floorings and ceilings are used in the wards and in all parts occupied by patients, also in the main administrative block at the north front. All staircases and passages are fireproof, except the staircases in the administrative block. Hydrants with all proper fittings and high-pressure fire mains thereto are provided within and without the building at all necessary points. The cubical and superficial contents of all wards, day-rooms, dormitories, single-rooms, and attendants'-rooms are regulated in strict accordance with the published "suggestions and instructions" of the Commissioners in Lunacy; indeed, care has been taken to adhere closely to these in all the arrangements and details of the design. Whilst ward accommodation is in this plan calculated for three hundred and ten patients, the administrative portion is designed to accommodate four hundred and fifty patients, thus providing for convenient further extension. Plans have been drawn for the addition of such extensions, and, keeping these in view, the low portions of the epileptic wards are in the original plan provided above with proper fireproof floors, so that they would be ready to receive the additional story at any time without uncovering the ward beneath. The adding of this upper story in the first instance would provide additional accommodation for fifty patients at an extremely slight increase on the original cost.

Plans have been prepared of the following necessary supplementary buildings, the positions suitable for which would vary upon different sites. An isolation hospital affording accommodation for eight patients, with day-room, attendants'-room, kitchen, etc., complete. The building is so arranged that if patients of both sexes were under treatment at the same time they would be kept thoroughly apart. Farm buildings suitable for an asylum of the size now proposed, with cottage for the farm bailiff. A mortuary, with accommodation for visitors, and a post-mortem room. A porter's lodge with weigh-bridge. The total cost of carrying out the design complete in every respect (excepting only laying out of grounds) is estimated at £45,000. Quantities have been taken out, and a contractor has expressed his readiness to carry out the work thoroughly and well at that price. The estimate includes the supplementary buildings just enumerated, and also numerous items which it has not been considered necessary specially to mention in the above description, *e.g.*, boilers, engines, laundry-machinery, cooking and baking apparatus, fencing for estate and airing courts, and shelters for the latter. If the asylum were erected for three hundred and ten patients only, the cost per bed would be £145; this figure would, however, be materially reduced if the building were erected in the first instance for a larger number. Within certain limits, the smaller the asylum the greater must be the cost per bed.

THE COLOSSAL STATUE OF BUDDHA AT BAMIAN.



Colossal Statue of Bamian. India. height 173 ft.

THE existence of the great statues of Bamian has been long known to Indian archæologists, but correct drawings of them, or reliable measurements, have never been brought home till now. At last they have been drawn and measured in a manner that can be depended upon; this is one of the many important results of the Afghan Boundary Commission. Officers of the Survey Department accompanied the Commission, and they have been busy at work all the time; the outcome of this will be reliable maps of the region. To carry out this, the survey officers have gone off on excursions in various directions; last November, Captain the Hon. M. G. Talbot, R. E., started, along with Captain Maitland, of the Political Department, on a survey route through the Koh-i-baba or Paropamisus

range. They went eastward along the Heri-Rud valley, from near Obeh, till they reached Bamian, a line of travel over which almost no European had before passed. Ferrier may perhaps have gone over a small portion of it at the western end. It is to Captain Maitland that we are indebted for the sketches of these great statues, as well as the remains of paintings on the walls of the niches and caves.

Bamian is on the road between Cabul and Balkh, where it crosses the Paropamisus range. The situation is high, being somewhere about 8,500 feet above the sea. The rock is conglomerate, or pudding-stone, of which there is a high cliff in the valley. In this, at an early period, probably during the first centuries of the Christian era, Buddhist monks excavated caves. These are in large numbers at Bamian — "extending for miles" — but there are numerous groups of caves besides, extending northward, along the road as far as Haibak. Judging by the remains in the Jelalabad valley, these caves would not be the only viharas or monasteries; there would be built structures as well. When Hwen-Tsang, the Chinese pilgrim visited Bamian, about 630 A. D., he states that there were 1,000 monks at it, and ten convents. He describes Bamian as a kingdom; but now we only know the spot from its caves and the great statues, which are remains of Buddhism, and not, so far as is known, the remains of anything like a capital city of a kingdom. There stand near to this spot the ruins of an old city, known as Ghulghula, which was utterly destroyed by Genghis Khan, in the thirteenth century. He gave the order that not a soul was to be spared — man, woman or child — all were to be slaughtered, the order was fulfiled, and the place has been a ruin ever since. Ghulghula may have been the principal city, of which Bamian was only a sort of suburb. This is confirmed by the Chinese pilgrim, who states that the statues were on "the northeast of the royal city." Alexander, in passing from Bactria to India, crossed the Paropamisus range either at Bamian or near to it; but the historians who describe his doings give no mention of the statues. This is, so far, evidence as to their non-existence at the time. It is also understood, as confirmation of this, that Buddhism could not have spread so far northward at that early date.

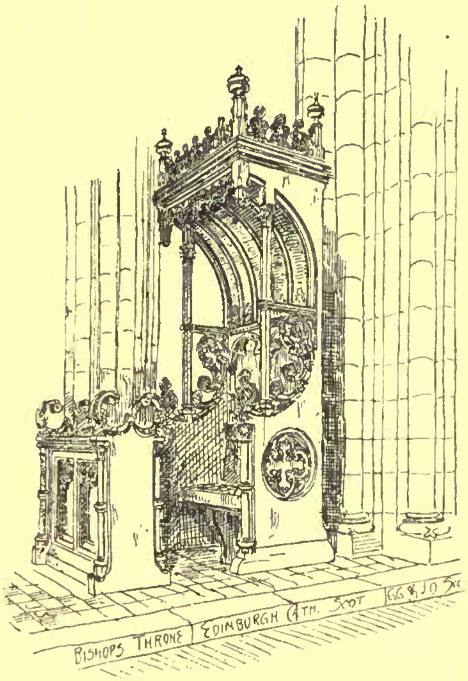
Hwen-Tsang, the Chinese pilgrim, is the earliest writer to mention the statues. In later times, they have been described by travellers, who had given them little more than a passing notice. Among these may be mentioned Burnes, Mohun Lal, who accompanied Burnes, Masson and Sir Vincent Eyre — who was one of the prisoners in the first Afghan war. The latest notice is that of Dr. Yavorski, who accompanied Stoletieff's mission to Cabul in 1878, and has published an account of the mission in Russian. These writers have generally done little more than repeat the local traditions respecting the place, which are chiefly of a Mohammedan kind. The statues are known in the present day as Sal Sal and Shah Mameh, and the Bacheh or child. The Hindoos, of which there are a few scattered about in Afghanistan, have also their own legends regarding them. All wonderful things in art or nature in India they attribute to the work of *Panch Pandu Ke Bhai*, or the Five Pandu Brothers; and of course, according to their ideas, the great figures at Bamian could only be produced by these heroes of the Mahabharata.

There are five statues at Bamian; three of them are in niches, which have been cut out, the figures being formed of the rock within the niche. The largest statue has been produced in this way. Its size has been variously estimated by travellers, some putting it at 100 feet, and others as high as 150 feet. Captain Talbot used a theodolite, and found that all previous estimates had been short of the truth. The figure is 173 feet high, which is only 29 feet lower than the London monument, the exact measure of it being 202 feet. The Nelson column in Trafalgar Square is 176 feet, just three feet higher than the Bamian figure, and thus giving almost an exact counterpart of its height. If a general meeting of all the colossal statues of the world could be brought about — if the Memnon figures from the banks of the Nile could come (they are 51 feet high, and would be taller if they could stand up out of their seats); the four Great Guardians in front of the Temple of Ipsambul (these are also sitting figures, about 50 feet high); the bronze Dai Bootz of Japan; if we can imagine to be reproduced for the occasion the statue of Athene, made by Phidias for the Parthenon, which was 39 feet in height; or the Olympian Jupiter of the same artist, 60 feet high, a statue celebrated for its great size as well as for its perfect workmanship; or even the still greater Colossus of Rhodes, the records of its height varying from 100 feet to 120 feet; if all these — and they are all well known to fame — were to meet at one place, and the almost unknown Bamian statue were to appear among them, what pygmies most of them would then seem! The colossal Apollo of Rhodes, one of the Seven Wonders of the World, would lose all pretense to superiority in height as he had to look up 53 feet — at the lowest estimate — to the gigantic strangers from Bamian. The new "Liberty" statue at New York is 111 feet high, but the distance to top of torch is 151½ feet.

The Chinese pilgrim estimated the height of the largest statue as 140 or 150 feet. In all probability it was originally gilt, for in his short description of it, he says: "Its golden hues sparkle on every side, and its precious ornaments dazzle the eyes by their brightness" (Professor Beal's translation). Captain Talbot says that the folds of the drapery have been laid on with stucco. Local tradition asserts that when the soldiers of Timur, who were Mohammedans, passed on their way to the invasion of India, they shot arrows at the idols; and that the troops of Nadir Shah fired artillery at them. This is to account for the dilapidated condition of the lower limbs of the figure. It will be noticed that there are small holes in the broken parts; these are supposed to have been made for wooden pegs to support mortar or stucco, which had been used in repairing the defects. As the Mohammedans would most willingly destroy such objects of idolatry, we must suppose that the efforts to restore the figure must have taken place as early as the time of the Buddhists. At the feet of the statue there are entrances, which communicate with stairs and galleries, so that the top of the figure can be reached.

Hwen-Tsang distinctly states that it is a figure of Buddha. This is of some importance, because it has been suggested that the figures belonged to the pre-Buddhist period. Captain Maitland's drawings are quite sufficient to determine this point, and the Buddhist character of the figure need no longer be a question of doubt. There is the well-known knob on the top of the head, the long ears, and the drapery arranged in folds, which all know who are familiar with Buddhist art. The influence left by the Greeks of Bactria, and which is so manifest in all the Buddhist remains in the Pesha-wur district, as well as in the Jelalabad valley, seems to be wanting at Bamian, or at least is so slight that it scarcely attracts notice. This is strange, as it might be expected that the farther north from India, the greater would have been the Greek influence. — *Illustrated London News.*

TESTING GAS-PIPES.



So many questions, says the *Sanitary Record*, are being addressed to us at this time of the year as to any scientific method for insuring gas-pipes against leakage, and for discovering exactly where the leaks lie, that we think it advisable, for the benefit of our readers generally, to reprint a portion of a chapter written by Mr. W. Eassie, C. E., on this subject, in his "*Sanitary Arrangements for Dwellings*," which is now out of print. Mr. Eassie says:—

In England, as a rule, we are culpably careless about our gas supply. A gas-company, for instance, receives notice that the service of such and such a house is ready to be connected with their main, and when they have obtained a signed agreement setting forth who is responsible for payment, the meter is connected forthwith, and there is an end of it. The gas-fitter may have done many things badly, and not done some things at all, but the gas-company seldom, very rarely ever, exercises any jurisdiction. The gas-fitter next sends in his account, which is paid, and when the smell of escaped gas from some faulty portion of the pipes has become unbearable, he is sent for to remedy it, and charges for the rectification. The workman may be thoroughly incompetent, as gas-fitting is not, as it should be, a separate trade. Indeed, the artisan who performed the work may be a blacksmith, whitesmith, glazier, brazier, plumber, bell-hanger and gas-fitter, all rolled into one.

A gas-fitter *who is a gas-fitter*, and who understands his business, will never take leave of a house until he has tested the pipes for leakage. Where this trouble is taken, the ordinary practice amongst us is as follows: When the pipes have been laid throughout the house, and the company's main connected to the meter, a temporary burner is fixed to each floor of the house, and the gas is turned on. The gas is now ignited at these trial jets and allowed to burn for some little time. The main is then turned off, and at the same time the exact reading of the index is taken. When the gas left in the pipes has burnt out, the taps of the experimental lights are turned off, and if, after the lapse of an hour or so, the dial of the meter continues to indicate a consumption of gas, it is plain that it somewhere escapes, and the leak is searched for by the sense of smell, etc., and remedied.

Whether from sanitary reasons or wholesome dread of fire, I do not know, but in most of the large cities of the United States every length of gas-pipe which has been laid in a house has to undergo even a severer ordeal than the above before the gas is laid on. The inspector examines the joints and elbows, scrutinizes the plugs where brackets and chandeliers are intended to be fixed, and if there is the slightest departure from the rules, he insists upon all being set right.

Before, however, the gas-fitter — a separate trade there — asks the gas-company to make the connection with their main, he sets about

proving the pipes. He stops up, with one exception, all the outlets which have been left for brackets and pendants with plugs or with screwed caps. On the one not so stopped he attaches a force-pump, into the interior of which has been put a few drops of sulphuric ether. This pump is now connected with a gauge, and it is then set to work, generally until a high pressure is registered. A high pressure in a gas-pipe at first appears unnecessary, but gas-fitters know very well that iron pipes have many latent weaknesses, so to speak—seams just ready to open, pin-holes filled with grease, etc., which might not drop out for years, and a good pressure exerted would rip up the one and cause the others to fall out. When the gauge indicates a certain figure, therefore, the pumping ceases, and if the mercury falls, it is evident that there is one or more palpable leaks, which are at once sought for. The escaped ether will guide the fitter to these, and the defaulting pipes are replaced by others. The pumping is now continued and the same routine recommences. If the mercury still descends and it cannot be detected, even by the sense of smell, the joints are separately lathered over with soap, whereupon the weak places will be indicated by bubbles. These parts are then marked, heated by means of a portable spirit lamp, made for the purpose, and covered over with an approved and durable cement. When the inspector arrives, the pump is once more set in action, and as the pipes are now tight, he has simply to cast an eye upon the gauge, the column of which no longer shows signs of sinking; examine, as before mentioned, how the pipes have been laid, and sign the requisite order. Some universal system of house-pipe testing should prevail here. It is common enough with us for gas companies to test the gas-pipes which constitute the main before they are laid down; but the house-pipes are seldom properly overhauled by any one.

Mr. Eassie has practised this last-mentioned method of testing gas-pipes for many years past, and with every success.

NOTES AND CLIPPINGS

Death of Baron Bourgeois, Sculptor.—Baron Charles Arthur Bourgeois, the French sculptor, has just died in Paris. Born at Dijon in 1838, he was a pupil of Duret and Guillaume and obtained the Prix de Rome in 1863 for his group "Nisus and Euryalus." The same year he made his début at the *Salon* with the "Serpent Charmer," which was repeated in bronze at the exhibition of 1864. Among his other well-known works were "La Pythie de Delphes," acquired by the State in 1870; "Un Esclave," a statue of St. John in stone for the church of St. Eustache; "La Religion," also a statue in stone, for the front of the Church of the Sorbonne; "Circe" and "Hero and Leander," groups and portraits of Lamartine and the Marquis de Barthélemy. Baron Bourgeois obtained two third-class medals in 1862 and 1870 respectively, and one of the second-class in 1873.—*N. Y. Evening Post.*

A Road of Glass.—By and by we reached the obsidian cliffs—a bluff from 150 to 250 feet in height and 1,000 feet in length. As it was necessary to build a carriage-way under this cliff, and indeed, I may say, across it, Colonel Norris accomplished it by building huge fires upon the larger masses and then dashing cold water upon the heated surfaces, which, being suddenly cooled, were shattered into fragments that were easily moved, and thus the road-bed is composed of broken obsidian or volcanic glass, but one would never imagine that he was driving over a glass highway unless he chanced to get a little beneath the surface and discovered a bit of obsidian that resembles the bottom of a bottle, as I did. The glass oozes from the rocks like gum from a tree. It is almost black, quite opaque, and the edges of it, when chipped off at a proper angle, are as sharp as razors. Of it the Indians fashioned arrow-heads, weapons and tools. The supply seems inexhaustible, for it is found in many parts of the National park, and these cliffs alone, as a mine, or fountain, shall I say, of glass, are probably unequalled in the world.—*Yellowstone Correspondence San Francisco Chronicle.*

The Loading of Chimneys and Walls.—In the *Zeitschrift des Vereines deutscher Ingenieure*, Herr A. Hollenberg communicates some interesting information respecting the effects of loading chimneys in preventing, or at least diminishing oscillations. A chimney only 56 ft. high, set in ordinary lime mortar without cement, when tested after completion for the degree of oscillation, displayed this property to such an extent that it was thought advisable to make its upper end more secure by placing a load on it. This was done by putting on the top an iron plate weighing 145 kilogrammes. This plate is stated to have proved a complete success. The chimney, which is rather exposed, has withstood since its erection (1870) many a storm, and shows neither horizontal nor vertical cracks. According to the *Praktische Maschinen-Constructeur*, similar results have been obtained by a mill owner at Müllfort, near Rheydt, by placing rails on walls. He found it necessary to erect two additional stories over the first floor, without, however, interrupting work in the factory But the constant vibration destroyed the brickwork as soon as it was erected. An attempt to hold the walls together by loading them with rails was so far successful that the two additional stories could be completed. The vibration of the walls was completely stopped by the load placed upon them.—*The Builder.*

The Mexican Calendar Stone.—After a careful analysis of the Mexican codices and graven inscriptions, Zelia Nuttall of the Peabody Museum, Cambridge, has reached the conclusion that the monolith known generally as the Calendar Stone, was really the market-stone of the City of Mexico, and that the pictographs upon it make up a record of fixed market-days, etc. The Sacrificial Stone is deemed by the same authority to be in reality a law stone "recording the periodical collection of certain tributes paid by subjugated tribes and others whose obligation it was to contribute to the common wealth of Mexico." Many of the large stone receptacles, vessels generally assumed to be for the purpose of holding the blood of the human victims of the sacrifice, are believed to be "the standard measures kept for reference in the market place." It would be rash to leap to the conclusion that because the purpose of these vessels has been misunderstood, there is room for charitable doubt as to the existence of the sacrifice of human victims to the Aztec deities. The paper from which we have quoted bears evidence to the general trustworthiness and accuracy of the early Spanish chroniclers of the conquest, Bernal Diaz and others who served with Cortez, or came into the country with the vanguard of the Spanish settlers. Diaz visited the temples in which the horrid rites were celebrated, and from the Spanish leaguering lines had witnessed the sacrifice of those of his countrymen who had been taken prisoners in one of the Mexican sorties from the besieged city. There is no more graphic or powerful chapter in Prescott than that in which he tells how the Spaniards heard the great serpent-skin drum booming from the summit of the teocalis on the midnight air, and, by the light of the great fires on the altar, saw their captive countrymen murdered on the rock of sacrifice. The Church of the Martyrs commemorates those of the Spaniards thus immolated to the Mexican gods. One likes to think well of a people who have developed civilization to the same degree as had the Aztecs, but the dark and bloody superstition which ruled them prevents one from lamenting their overthrow, even when accomplished by that nation which abjectly bowed to the behests of the Inquisition.—*The N. Y. Times.*

TRADE SURVEYS

The year's business is pronounced satisfactory, at least as to volume. Two or three new factors are about entering which will exert an influence upon the country's business. One is speculation one is financial, and one is labor. We are threatened with an era of speculation, in some directions, which may result injuriously. From the smallest dealer to the heaviest manufacturer, larger stocks or supply of goods are being contracted for, and each in turn is covering what he imagines to be his requirements for the next three or six months. Even in the ordinary commercial channels speculation is exhibiting itself, and manufacturers and jobbers are encouraging rather than discouraging it because of the anxiety to secure and retain customers. In the iron trade a speculative feeling is distinctly observable. Furnace companies have sold their products from three to eight months ahead, and a portion of this business is placed by buyers who expect to sell to other parties. Rail-makers are sold from five to eight months ahead, and over 100,000 tons of material have been contracted for abroad. These companies have sold 1,200,000 tons of rails already, and new rail-mills are to be built, besides some forty building or projected blast-furnaces of the highest producing capacity. The bridge-makers have united to further their common interests, and the nail-makers, bar-iron and wrought-iron manufacturers have done the same. Combination and expansion are apparent in every industry. Coal-mining interests are in a more compact shape for the new year because of the greater demand. The machinery-makers are also crowded and car and locomotive favorably enough. That the favorable conditions, financial and industrial, will continue, there is but little room for doubt. One industry alone, iron and steel, have sold over one hundred million dollars worth of material. The machinery-makers and supply-houses and mining-interests have also enormous contracts in hand. It is learned from safe sources that a policy of buying for forward requirements, will be pursued from this out. Even the lumber-dealers and manufacturers are looking sharply around for turns in the market, and most dealers are safe either in stock or contracts placed. The textile manufacturers have entered the year under excellent conditions, and only need about three months more of healthy activity to mark up prices. The boot and shoe manufacturers have some cause for complaint, but a better season awaits them. The tool and small machinery makers, and makers of small railway material, besides manufacturers of electrical appliances are quite crowded, and orders for future delivery cannot be placed at December prices, and the probability for a further general advance is stronger to-day than a month ago. Throughout the East a healthy feeling prevails, especially among architects and builders. Several municipal improvements will be made. Large sums are to be expended for school-houses, churches and educational establishments. Bank and office building will be more general than last year. In New York 4022 houses were built and projected, the cost of which is estimated at 58,429,-653, an increase of nearly 25 per cent on 1885. Philadelphia's building-activity has been frequently spoken of, and real estate is advancing. Pittsburgh is active, and real-estate is in demand. In several manufacturing towns in Ohio and Indiana much building is determined upon, and in several states in the Northwest building and industrial operations will be prosecuted on a large scale. Railroad-building activity is the cause of much of this activity, and of more of the confidence. Low prices have stimulated enterprise, and high prices, after a time, will repress it. The third factor is likely to affect us favorably or injuriously, the labor factor. The leaders will seek to avoid trouble, it is now given out semi-officially, and will be undertaken. Higher wages will not be demanded so boldly; when demanded, friendly negotiations will be solicited. Wages will be advanced from time to time by manufacturers and employés who desire to live at peace and avoid conflicts. Employers will not rest content with the partial organization effected. There is no real difficulty in the way of a harmony of interests. During the past year sixty different trades were united because of the labor agitations, and by the close of this year very few will be left unprotected. With all this organization there is a growing liberality of sentiment among employers and a decline of the old antagonism among workmen. Both sides exhibit more wisdom. The frequent failures of the past year, the threatened disintegrating tendencies in organized labor, the possibility of a depression in a year or two, all act to strengthen the conservative tendencies now at work among labor organizations and leaders. In New York and Philadelphia, and to a certain extent in Chicago and St. Louis, the various unions have already passed upon the wages and hours of labor and have decided to let well enough alone. This will be the general result everywhere.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, TICKNOR & COMPANY, Boston, Mass. No. 577.

JANUARY 15, 1887.

Entered at the Post-Office at Boston as second-class matter.

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A GOOD deal of discussion is going on, particularly in the Western States, in regard to the establishment of a system of licensing architects, in the same way that physicians are already licensed in many States, and it seems likely that two or three experiments of the kind, at least, will be tried before another year. The plan proposed is to establish a Board of Examiners, who will examine all candidates for the practice of the profession, and, if they find them possessed of the requisite knowledge and skill, will recommend them for a license. There can be no doubt that in the case of the medical profession the system of requiring evidence of skill in the shape of a diploma of recognized value, as a condition of exercising that profession, has worked well, and the official records of the States in which the system has been adopted contain many amusing accounts of the struggles of the authorities with the ignorant and heartless charlatans whom they finally succeed in dislodging; but there is some doubt whether the application of a similar rule to those who wish to be architects would be so easy. There is no question that it is as desirable to make sure that architects understand their business as that doctors comprehend theirs; but while the attainments of physicians are inquired into and attested by bodies of examiners at the medical schools, whose interest as well as duty it is to make their examination thorough, and keep their standard high, those who wish to become architects can in this country rarely show the diploma of a recognized school of architecture, and must depend, for the attestation of their qualifications on the verdict of a board of strangers sitting at rare intervals, serving usually without pay, and obliged to hurry through their work. In the majority of cases the decision of the Board would undoubtedly be correct, but there would sometimes be cases where unfit persons would present themselves for examination, and a license once granted could not easily be revoked. We think that the examiners in most medical schools would say that their acquaintance with the candidates, particularly in the case of men whose rank on the examination list is rather doubtful, often proves to be of great value, and the personal element in such tests cannot well be dispensed with. In the case of architects it might perhaps be secured, with advantage to all parties, by committing the examination, or at least some portion of it, to local professional associations. If we are not mistaken, the Boston Society of Architects, one of the largest in the country, already requires that candidates for membership shall pass a satisfactory examination before a committee appointed for the purpose; and although it would, perhaps, be premature to expect that private associations should be empowered to represent the public in granting licenses, their certificate of admission might be accepted at least for a part of the required evidence of qualification, and it would be as easy for them to examine a dozen applicants a month as one. To the local associations of architects, some such public recognition of their authority would be of considerable service, and in return, the assumption by them of the duties of holding at least the preliminary examinations for license would not only relieve the public, but would have the advantage of providing candidates about whose general character something was known. At present, of course, no one can be elected to a professional society without the recommendation of a committee of some sort, whose duty it is to inquire into his antecedents, and if the local societies were to take charge of public examinations while they could not exclude candidates, they would be sure to know something about nearly all of them, and might at least, as do the masters of preparatory schools, add some sort of personal observations to the statement of the results of the examinations.

SOME weeks ago a demonstration of trades-union principles took place in New York, which excited unnecessary astonishment among the newspaper editors and other persons in that city who enjoy the untrammelled use of their faculties. Mr. Lewis H. Williams, a very well-known builder, and a man of the highest integrity and ability, made up his mind long ago that he could manage his own business better than any one else could manage it for him, and has for years carried out the succession of important contracts with which he was entrusted in such ways as seemed to him best. One of his ways was to try to interest his men in their work, and to inspire them, as well as other persons who knew him, with confidence and regard, and we can testify from personal knowledge that he succeeded. In the course of his business he became satisfied that he could reduce the number of working hours of his men, without much detriment to his own interest, and with advantage to them, and more than two years ago he voluntarily made his week's work consist of fifty-seven hours, instead of the customary sixty. Six months later, in the hot, but busy months of June, July and August, he reduced the number to fifty-three hours, by stopping work at noon on Saturdays, and about a year ago he made another change, by which the fifty-three hour standard, with the Saturday half-holiday, were made the uniform rule throughout the year. All this was done, it is needless to say, without consulting the union officials, and he selected his men in the same way, employing those whom he considered honest and faithful, without regard to their society affiliations, and paying them according to their skill, his scale of wages varying from three dollars and a quarter to five dollars a day, the rates remaining unchanged throughout the successive reductions of working time.

LAST November, Mr. Williams, out of the kindness of his heart — for he could have had no selfish interest in making so large a sacrifice — issued a circular to his men, offering not only to continue their wages as before, but, in addition, to divide among them regularly one-half the profits of his business, in proportion to the wages which each one earned. As his business is a large one, keeping about one hundred and fifty men employed, and is managed with great prudence and success, this offer was naturally a tempting one, and was immediately accepted by the men. Meanwhile, however, the professional friends of the workingman had heard that Mr. Williams's employés were becoming so contented with their lot as to be in danger of forgetting their allegiance to the "walking delegates," but when they learned that they were actually on the point of sharing in the profits of the business, their alarm lest they should not only "accumulate some wealth," but also some foresight and energy, became so intense that they resolved to interfere at once, before the men should get too far away from the condition of mind which they consider suitable for working persons; and Mr. Williams was served with a "demand" that he should immediately discharge all his non-union men, and should level off the wages of the others to a uniform average of three dollars and a half a day. Mr. Williams submitted this summons to his men, who voted unanimously that they preferred his terms to those ordered by the union, and that they would keep to their agreement. Even the men who were paid, exclusive of their share in the profits, but three dollars and a quarter a day, instead of the rate required by the union, joined with the others, frankly acknowledging that their work was worth no more, and that they would much rather take that than go without employment, as would otherwise

probably be the case; while those who received four and five dollars a day, with a dividend at the end of the year in addition, naturally viewed the union's proposal to reduce their wages with very little favor. The union leaders, finding their commands disregarded, began to make a display of that terrible power which they use so cruelly, and ordered a general strike on all the buildings in which Mr. Williams's men were engaged, sending, at the same time, delegates to threaten the individual workmen who belonged to the unions. Three of these were so far frightened that they left their work, but two of them came back a day or two later, and the struggle between the overwhelming force of organized and drilled industrial slavery on one side, and new-born independence and hope on the other, has gone on ever since, with the result still undecided. The temper of Mr. Williams's men, and the intelligence with which they uphold their cause, may be judged from a remark of one of them to a reporter of the New York *Times*, which is well worth remembering. Speaking of the system of profit-sharing, this man observed that it was "of peculiar benefit" to the men of inferior skill, for the reason that it interested his companion in teaching and helping him, so as to enable him to do his part of the work with a rapidity and knowledge proportionate to theirs. "Under the union's system," said he, "if one of these men gets stuck on a piece of work which he does not understand, and asks a fellow-workman for advice, he will not get it. On the other hand, with us there is a common interest which makes us help each other, and if a fellow needs a little help he gets it readily, because we all want the job done as quick as possible, so that the division of profits may be more satisfactory." There is material for a volume of social science in these few words, as well as for a good many sermons.

THE *Deutsche Bauzeitung* gives a brief but interesting account of the journey to Japan of Herr Wilhelm Böckmann, the distinguished architect of Berlin. It will be remembered that a year ago a commission of high Japanese officials was sent to Europe to inspect the principal public buildings, and to get such information in regard to the more eminent architects and their work as would enable the Government to select an architect to design and carry out a series of great building works which it has now in contemplation. The Commissioners did their work well, and made an excellent choice in nominating Messrs. Ende and Böckmann of Berlin, whose names are connected with much of the best and most beautiful building in Germany. As soon as the preliminaries had been settled, Herr Böckmann started for Japan, to look over the ground, study on the spot the conditions of the problem, and consider the methods of obtaining proper material for works of a sort as yet little known in Japan. He took with him one of his assistants, Herr Mänz, intending to leave him in general charge of the work on the ground. The two gentlemen left Berlin early in the spring for Brindisi, where they took a steamer for India by the way of the Suez Canal and the Red Sea, and from India sailed to Japan, reaching Tokio on the thirtieth of April.

HERE they were received with much distinction, and were assigned quarters in the house which the Japanese Government has built for the reception of its guests. Their first business was to examine the ground set apart for the proposed group of public buildings, and Herr Böckmann had the courage at once to pronounce it unsuitable. His opinion was listened to with respect, and he was requested to make plans for providing a more suitable site; and, although his new plan, which necessarily looked to the effective and dignified grouping of a number of very large buildings in the best position in a city of a million inhabitants, involved a considerable amount of demolition and rearrangement of streets, it was adopted. A month was spent in overcoming this unlooked-for difficulty, before Herr Böckmann's intended work could begin; but he proceeded at once with his preliminary sketches for the first buildings to be erected, consisting of the Parliament House, the Imperial Court-House and Ministry of Justice, and the Prefecture of Police. By what must have been extraordinary industry, combined with great capacity and experience in mastering such complicated problems, he completed his sketches for all these buildings, and obtained their approval from the Government, in about a month more, and still had time to examine stone-deposits and clay-beds enough to decide upon the site of brick-yards, and of certain quarries, before the second of July, when he left Tokio for home by way of San Francisco and New York, arriving in Berlin on the fourteenth of August, after making in five months a journey around the world, including a stay of two months at the antipodes. From the sketches brought back to Berlin the working drawings are to be made, and in the spring of this year, Herr Ende, the other partner in the firm, will take them to Japan, and direct the laying of the foundations. The construction of the two most important buildings, which will occupy about five years, is to be carried on under the responsible supervision of Messrs. Ende and Böckmann, but the Prefecture of Police is to be built under the care of Herr Mänz, and of Mr. Josiah Conder, a clever English architect who has for several years held an official position in Japan; Messrs. Ende and Böckmann giving the work only general direction. For the better control of the workmen employed on the buildings, arrangements have been made to send immediately to Berlin two young Japanese architects, who will be taken into Messrs. Ende and Böckmann's office, and twelve young mechanics, who are to be distributed among the best houses engaged in their special trades. These men, by the time their services are required, will be tolerably familiar with European methods of work, and will be also of great use as interpreters.

A VIGOROUS effort seems about to be made to convert Paris into a seaport, by means of a ship-canal extending from Rouen, the present head of navigation on the Seine, to Saint-Denis, the manufacturing suburb of Paris. It will be remembered that Paris is already, with perhaps the exception of Buffalo or Chicago, the most important centre of inland navigation in the world, and the Parisians, who see constantly before them the spectacle of London, with its forests of ships, forty miles from the sea, have for many years desired to find means for uniting a waterway to the sea, comparable with that which London enjoys, with the network of inland canals which it alone possesses. It is likely to be a long time before an artificial Thames extends from Paris to the Channel, but in the meanwhile a good canal will be much better than nothing, and this can, if the French Government grants the concession desired, be built at once, at the expense of a private company, which has adopted the plan prepared by M. Bouquet de la Grye, and is ready to construct the canal without cost to the public treasury, asking in return only the right, for ninety-nine years, to collect a toll, not exceeding three francs per ton, on all vessels passing through the canal, to or from Paris, together with the privilege of cultivating or renting the portions of the bed of the river laid dry by its construction. The canal which the company proposes to build will follow in general the bed of the river from Saint-Denis to Rouen, but the channel will be straightened and regulated by artificial banks, and two of the long bends of the river, at Pont de l'Arche and Sartrouville, will be cut off by a straight ditch across the chord of the arc formed by the present channel. There will be three locks, and perhaps a fourth, but the canal will be so wide and deep that vessels can pass through it quickly, and the time occupied in the passage from the sea to Paris will not usually exceed twenty-four hours. The proposed depth is six metres, or about nineteen and one-half feet, which will be sufficient for vessels of two thousand or twenty-five hundred tons, and the width will be one hundred and fourteen feet in the straight parts, and one hundred and forty-six feet at the curves, so that ships can meet and pass at any point. Although twenty-six existing highway bridges will have to be altered over into drawbridges, it is remarkable that no important railway is intercepted by the canal, and, by changing slightly the course of the present line from Paris to Havre, it will be possible to avoid interrupting any important railway route. According to the Commandant Cugnin, who writes an interesting description of the scheme to *La Semaine des Constructeurs*, the cost of constructing the canal will be about twenty-two million dollars, and it can be finished in three years. With the rate of tolls proposed, the cost of carrying merchandise to Paris in the same vessels that have already brought it to Rouen will not exceed ninety-six cents per ton, while the cost of transhipping it to lighters at Rouen, and conveying to Paris, under the present system, is about a dollar and eighty-three cents per ton. By means of this great saving it is hoped that Paris, as a point of embarkation for goods exported from Switzerland and eastern France will be able to compete with Antwerp, which is rapidly securing a large part of the maritime business of the Continent.

TRAP SIPHONAGE.[1]



ENGLISH CHAIR.. FROM THE MONITEUR DES ARCHITECTES.

THE experiments on trap siphonage made by S. S. Hellyer, of London, and similar experiments conducted by Philbrick and Bowditch, of Boston, clearly proved the utility of trap ventilation. The experiments of George E. Waring, of Newport, and J. Pickering Putnam, of Boston, as clearly (apparently) proved the uselessness of such ventilation. In the preparation of a work on plumbing, I found this conflict of authorities very perplexing. In fact, it was impossible for any one to form a definite conclusion on the efficiency or inefficiency of trap ventilation without actual experiment. The difficulty and the object to be attained were laid before Dr. J. Mills Browne, medical director, United States Navy, in charge of the Museum of Hygiene at that time. Upon consulting with the surgeon-general of the navy the subject was thought of sufficient importance to have a system of iron and lead pipes with fixtures erected outside of the museum building. With these pipes I have been conducting experiments from the fall of 1885 to the present time, as opportunity would permit. The waste and vent pipes are of the sizes used and arranged as in common practice. The traps on which the tests were made were selected so as to cover the different kinds in the market, both mechanical and non-mechanical. The apparatus is so arranged that the fixtures can be subjected to a strain equal to what they would receive in actual use, as well as strains more severe than they would have to withstand, except in unusual contingencies.

The points or places of inspection, and for the attachment of traps, are platforms located on the first, second, third and fourth stories, as shown in the drawings attached hereto. By this arrangement the effect of water discharged from varying heights can be thoroughly tested in their relations to the different stories of a building. There is a marked change in the effect produced in different stories of a building by a discharge of water from the same point.

The main stack of pipe is of four-inch extra heavy cast-iron, starting at a connection with the sewer (branches, valves, and connections being inserted at the proper points) and running thence a distance of thirty-two feet horizontally, and forty-two vertically, to a point above the roof of the building. In the second story there is an auxiliary stack of four-inch lead pipe connected with the iron pipe and running to a point above the roof. Both the iron and lead pipes have running-traps and fresh-air inlets near their points of commencement, with valves and screw-plugs, by which they can be partially or completely closed as desired. By means of a Y-branch the system can be made to empty into the sewer without passing through the running-trap. Either outlet can be used at pleasure, both being governed by gate-valves. Two stacks of three-inch vent-pipe (one lead, the other iron) run vertically from the second story to the roof, thence horizontally along the roof. By means of plugs and valves the lengths of the vents may be varied from a few feet to forty-two feet, and the opening from nothing to three inches. The outlets in both the soil and vent pipes are so arranged that traps from one and one-fourth to four inches, can be attached at pleasure, all outlets not in use being cut off by gate-valves or screw-plugs.

Siphonage, caused by the discharge of water through the trap itself from a fixture above, has been found of very little consequence: siphonage rarely takes place, the water passing over the long arm of the siphon rarely fills the pipe so as to cause the necessary vacuum. When it does take place, the trap fills by the drainage from the fixtures above, such as the wash-basin or sink. The back-pressure which comes from sewers would never force the seal of a trap in a house plumbed according to modern practice, the fresh air-inlet and the top of the soil-pipe being always left open. The greatest danger arises from the discharge of large bodies of water down the long vertical four-inch pipes. This column acts to a certain extent like a piston, compressing the air in front of it and creating a vacuum behind it. The air rushing in to fill the vacuum forces or draws the water from the traps into the soil-pipe, while the compressed air finds its easiest mode of escape through the traps below the point of discharge, even when there is a fresh-air opening between the running-trap and the house. Although the water, in case of back-pressure, is driven up into the pipe or fixture above the trap and then returns to the trap, *the sewer air passes into the house.* The majority of the experiments have been made to test the power of traps to resist the siphonage and back-pressure produced by the column of water passing down the vertical pipes. The question of first importance is: *Does ventilation protect the seal of traps in ordinary use?* This question is answered by the following experiments, in all of which the vent-pipes were open, and a positive effort was made to break the seal of the trap. In the first experiment the fresh-air inlet at the foot of the soil-pipe and the opening at the roof were closed, in this way subjecting the traps to the greatest strain which they could possibly have to resist for either siphonage or back-pressure:

EXPERIMENTS.

Number 1. A 3-inch lead trap was attached to the outlet in the second story and the water discharged from the tank in the fourth story through a 4-inch opening; the column of water passing down the vertical pipe a distance of 30 feet before it reaches the branch to which the trap is attached; the air confined in the 4-inch pipe between the running-trap and water-column was forced out with considerable violence through the vent-pipe; the outlet of vent in trap was 2 inches in diameter and ran into a 3-inch vent-pipe, which extended up above the fourth story; a discharge of 15.5 gallons created a slight commotion in the trap, from a sixteenth to an eighth of an inch, splashing out when the trap was full.

Number 2. The same discharge, same condition (except the small amount of water shaken out of the trap), no effect.

Number 3. Same as Number 2.

Number 4. A 1½-inch trap was connected at the same point, the 3-inch lead pipe being removed: inch vent-pipe open, 15.5 gallons discharged from the tank; water only shaken a little; none thrown out.

Number 5. Same conditions; 7.75 gallons discharged through 4-inch opening in tank; no effect on the seal of trap.

Number 6. A discharge of 15.5 gallons through 2-inch opening in tank; no effect on the seal of trap.

Number 7. Same as Number 6.

Number 8. Same as Numbers 6 and 7.

The fresh-air inlet was now opened and the following experiments tried:

Number 9, Sanitas trap attached; 7.75 gallons discharged through 4-inch opening; no effect on seal.

Number 10. Same as Number 9.

Number 11. Same as Numbers 9 and 10.

An opening was now left near the top of the soil-pipe, a practical illustration of an open fresh-air inlet and top of soil-pipe, and the following experiments tried:

Number 12. A 1½-inch lead trap was attached at the same point; 15.5 gallons discharged through the two-inch opening of the tank; no effect on the seal of trap.

Number 13. Same as Number 12.

Number 15. Fred Adee's 1½-inch trap was connected at the same branch of the soil-pipe. 1-inch discharge of 15.5 gallons through the 2-inch opening of the tank. No effect on the water-seal of the trap.

Number 16. Same condition; same effect.

The point of experiment was now transferred to the third story and the traps attached at that point, the discharge being made from the same tank on the fourth story.

Number 17. A 1½-inch Bennor's trap was connected with the branch from the main soil-pipe; discharge of 15.5 gallons through the 4-inch opening in the tank. No effect on the seal of the trap.

Number 18. A small 1½-inch S-trap was inserted; the same discharge and the same effect.

Number 19. A 4-inch S-trap was connected. Same discharge; same effect.

The following experiments were made with vents more or less closed:

Number 20. A 4-inch S-trap. The outlet to vent was half closed. There was considerable commotion in the trap, but the seal was not in any way affected by 7.75 gallons discharged from the tank through the 4-inch opening.

Number 21. Same experiment; same effect.

Number 22. The outlet of vent was three-quarters closed, and a discharge of 15.5 gallons was let out of the tank. There was a great commotion in the trap, the water being lowered until only a quarter of an inch seal remained.

Number 23. The 4-inch lead S-trap in position; the top of vent-pipe half closed; no effect from 7.75 gallons discharged through the 4-inch outlet in the tank.

Number 24. The same trap; outlet of vent quarter closed; one discharge from tank through the 4-inch opening in the tank; water lowered five-eighths of an inch in trap.

Number 25. Same as Number 24.

Number 26. The same trap; the top of vent half closed; one discharge of 15.5 gallons through the 2-inch outlet of the tank. The water was lowered five-eighths of an inch.

Number 27. Same as Number 26.

Number 28. Same as Numbers 26 and 27.

Number 29. Same trap; same vent half closed; 15.5 gallons discharged through the 4-inch outlet of the trap. The air was drawn through the trap and 2 inches of water taken out. The seal was not broken. The trap was refilled.

Number 30. Same as Number 29.

Number 31. Same as Number 29.

Number 32. One discharge of 7.75 gallons, the top of vent being seven-eighths closed and the trap was siphoned.

Number 33. Same as 32.

Number 34. Same as Numbers 32 and 33.

A question of equal importance is, *are unventilated traps siphonable or are some varieties siphonable and others not so?* If some are unsiphonable and at the same time not affected by back-pressure it is important to know which they are. The following array of facts will answer the question:

In the following experiments the vent-pipe was closed, unless otherwise noted. The first tried were with the top of soil-pipe open and the fresh-air inlet closed.

[1] Report on experiments in trap siphonage at the Museum of Hygiene, U. S. Navy Department, Washington, D. C., and read as a paper at the recent Convention of the American Institute of Architects, by Glenn Brown, architect.

Number 35. A 3-inch lead S-trap was connected to one of the branches on the second story, and 15.5 gallons were discharged from the tank in the fourth story through the 4-inch opening. The confined air in the pipe between the running-trap and the descending column of water was forced through the trap, carrying the water with it. This passage of air continued as long as the water was flowing through the pipe from the tank.

Number 36. Same discharge from the tank. A small amount of water was blown out by back-pressure; then the trap was siphoned to 1¼ inch below the seal of the trap.

Number 37. Same as Number 36.

Number 38. Same as Number 36 and 37.

Number 39. Twenty-three gallons were discharged through the 4-inch opening in the tank The water was thrown up above the trap by back-pressure, playing above the trap like a fountain, a large part of it falling back into the trap, after which siphonage took place, as in experiment Number 36, leaving an eighth of an inch seal in the trap.

Number 40. A 3-inch lead S and a 3-inch lead U and a 1½ Sanitas trap were all attached to the same branch on the second floor. 15.5 gallons were discharged from the tank on the fourth floor through a 4-inch opening. The two lead traps were siphoned and half the water taken out of the Sanitas trap.

Number 41. Same as Number 40.

Number 42. Same as Numbers 40 and 41.

Number 43. The two lead traps were then cut off and the discharge sent through the pipe, the Sanitas S-trap was two-thirds emptied.

Number 44. Similar discharge without the trap refilling. The Sanitas trap was siphoned, only an eighth of an inch being left in the trap.

Number 45. A small 1½-inch S-trap was inserted at the same place; 15.5 gallons discharged through the 4-inch opening in the tank. The trap was siphoned.

Number 46. The same trap was removed to the second floor and 15.5 gallons discharged through the 2-inch opening in the tank. The water was blown out of the trap.

Number 47. Same as Number 46.

Number 48. Same as Numbers 46 and 47.

The following experiments were made with the top of the soil-pipe and the fresh-air inlet both open, making a system of pipes the same as are now most commonly used in our houses:

Number 49. A large 4-inch S-trap and a 1½-inch Bennor's trap were connected with the soil-pipe branch in the third story; 15 5 gallons discharged through the 2-inch opening in the tank. The Bennor's trap was not affected, while the 4-inch S-trap was completely siphoned. In this case the S-trap formed a vent for the smaller trap.

Number 50. The S-trap was removed and the same discharge made. The water was completely drawn out of the glass cylinder of the Bennor's trap.

Number 51. Another similar discharge without refilling the trap, and the seal was broken. The water would be drawn by siphonage beyond the ball into the cylinder, when the ball would take its seat, and the water would not pass back into the lower part of the trap. This shows the ball to be effective against the back-pressure in a new trap of this make.

Number 52. A Sanitas trap was put in at the same place; same discharge as above. Half of the water was taken out of the trap. The air passed through the trap rapidly, creating a continuous commotion in the water. The bulk of the water seemed to be thrown out against the separator in this trap and to fall back without passing out.

Number 53. Same trap; same discharge, one-eighth of an inch being extracted.

Number 54. Same as Number 53.

Number 55. A 1½-inch lead S-trap, Bower's 1½-inch trap, and a 4-inch lead S-trap, all connected at the branch in the third story; a discharge of 15.5 gallons through the 2-inch opening in the tank. The Bower's trap was lowered to within a half-inch of the seal, the small S-trap to within 1 inch of the seal, and the large S-trap to within two inches of the seal.

Number 56. Same discharge; the S-traps not affected. A small amount of water drawn from the Bower's trap. The traps were not refilled.

Number 57. Same discharge; same effect on the S-traps. The Bower's trap was lowered to within an eighth of an inch of the seal. As soon as the air began to pass freely through the Bower's trap it acted as a vent for the two S-traps, the air finding its way into the soil-pipe.

Number 58. The small S-trap was removed and 15.5 gallons sent through the pipe from the 2-inch opening in the tank. The Bower's trap not having been refilled, was lowered to the seal; the air passing freely through it formed an excellent vent for the large S-trap.

Number 59. Same experiment, the Bower's trap partly closed; the S-trap was immediately siphoned, the seal being broken.

Number 60. Same as Number 59.

Number 61. The 4-inch S-trap in same position. The vent was connected with the 3-inch vent-pipe, 20 feet long, closed at the top; 7.75 gallons discharged through the 4-inch opening in the tank. The trap was siphoned, seal being broken, the elasticity of the air in the long vent-pipe having no effect in preventing siphonage.

Number 62. Same as Number 61.

Number 63. A 3-inch lead S-trap was attached to a double Y on the second story. 15.5 gallons were discharged through the 4-inch outlet of the tank, the running-trap was cut off, and direct outlet to sewer used. Half an inch was blown out of the trap; the trap was not refilled.

Number 64. Same discharge. A quarter of an inch more was blown out by back-pressure.

Number 65. Same discharge; one-eighth inch more blown out of the trap.

The following experiments were tried with the top of soil-pipe and fresh air inlet closed:

Number 66. The Sanitas trap was attached to the outlet in the second story. 15.5 gallons were discharged through the 2-inch outlet in the tank; the seal of trap destroyed by the back-pressure.

Number 67. Same as Number 66.

Number 68. Same as Numbers 66 and 67.

Number 69. Same trap; 7.75 gallons discharged through the 4-inch outlet of the tank; water first blown out of trap, then taken out by suction.

Number 70. Same as Number 69.

Number 71. Same as Numbers 69 and 70.

The following experiments were tried with the top of soil-pipe closed and the fresh-air inlet open:

Number 72. A large 4 inch S-trap was inserted in the third story, a Bennor's trap in second story, and 15.5 gallons discharged through the 4-inch opening in the tank. The seal of the 4-inch trap on the second story was broken, while the seal of the Bennor's trap on the first floor was not affected.

Number 73. Same as Number 72.

Number 74 Same arrangement of traps; 31 gallons discharged through the 4-inch opening in the tank. The S-trap siphoned, ¼ inch drawn out of Bennor's trap, S-trap refilled.

Number 75. Same arrangement of traps; 15.5 gallons discharged through the 4-inch opening in the tank. The S-trap siphoned, inch, drawn out of Bennor's trap, S-trap refilled.

Number 76. Same conditions. The water would rise slowly, the ball moving perceptibly until it passed over the top of the out-go, a small amount at a time. The vacuum in branch on the second story seemed to be caused by the friction of the column of water passing the branches, as it siphoned before the water column passed the branch.

Number 77. A 1½-inch Sanitas trap was attached to the branch in the third story, and a discharge of 15.5 gallons through the 4-inch openings in the tank. Half of the water was taken out of the trap.

Number 78. Same trap; same conditions. Twenty-seven gallons were let out by accident, and the trap was lowered three-eighths of an inch below the seal.

Number 79. Trap was not refilled; 15.5 gallons discharged; one-quarter of an inch drawn out of the trap.

Number 80. Same trap; same discharge; one-quarter of an inch taken out of the trap.

Number 81. Same as Number 80.

Number 82. Same as Numbers 80 and 81.

Number 83. A 1½-inch Sanitas was put in same place; a similar discharge. The water was drawn completely out of the trap, leaving only a tablespoonful.

Number 84. Same conditions; 7.75 gallons discharged through a 2-inch opening in tank; same effect on the traps.

Number 85. Same trap was attached on the second story and 7.75 gallons discharged through the 4-inch opening in the tank; half the water was blown out.

Number 86. Same discharge; half the remaining water was blown out.

Number 87. Same discharge; only a sixteenth of an inch left in the trap.

Number 88. Same trap; same conditions; 15.5 gallons were discharged; three-quarters of the water was blown out of the trap.

Number 89. Same discharge; the whole amount of water was blown out, leaving only a trace.

Fresh-air inlet closed; top of soil-pipe open:

Number 90. A 5-inch lead S-trap was attached on the horizontal pipe on the first or ground floor, and Dececo, Boyles, Zane, and Meyers closets were discharged simultaneously with no effect on the trap.

Number 91. Six closets were discharged simultaneously with no effect on the trap.

Number 92. Small S-trap was inserted; no effect.

Number 93. Same as Number 92.

Number 94. Discharged 15.5 gallons from the tank; a small amount of water was blown out of the trap.

Number 95. Same as Number 94.

Number 96. Same S-trap was inserted in the second story and closets on first story discharged; no effects on the traps.

Number 97. Same as Number 96.

Number 98. Small lead S-trap inserted in third story and water-closets discharged on first story; no effect on the trap.

Number 99. Same as Number 98.

RECAPITULATION.

The Vent-Pipes on Trap Open. — In experiments Number 1 to Number 9 the top of the soil-pipe being closed, the only means of ingress for air to fill the vacuum is through the traps of their vents. This is the most severe test to which the traps can be subjected for siphonage. The fresh-air inlet being closed, the air in the pipes between the down-coming water and the running-trap must necessarily find its way out through the running-trap or through one of the traps connected with the soil-pipe. A strong current of air did, in every case, pass outward through the vent-pipe. Such strains would never occur in actual work unless the soil-pipe and fresh-air inlet should happen to become stopped. This is of rare occurrence in the top of the soil-pipe, sometimes happening from collections of snow or frost. The fresh-air inlet, as it is generally put in, may be easily closed by earth or dirt collecting on the perforated or grated opening. Experiments from Number 9 to Number 11: The fresh-air inlet was open; back-pressure was not great, while the siphon effect was the same. The condition of experiments from Number 11 to Number 34 were what would exactly have to be encountered in actual practice. The simple lead S-trap is acknowledged by all, to be the trap which is the most easily siphoned. It will be seen, by referring to the experiments from Number 1 to Number 34, that in no case was I able to siphon or force by back-pressure the seal of an S or any other kind of trap when it was properly vented. From that I conclude, that *traps, when Properly Ventilated, are not Siphonable.*

It has been asserted that when the vent is placed on the crown of a trap that in time it becomes choked up by refuse matter adhering to the surface. In these experiments the vent has been put in different positions, and it makes no difference in its effectiveness as long as it is between the trap and the vertical soil-pipe. With a little care the Y can be so placed and shaped that matter passing through the pipe would not adhere to the vent.

Experiments from Number 20 to Number 34 were tried with the vent on roof more or less closed. By these it can be seen that a vertical vent-pipe less than 3 inches, when the trap is connected with the 4-inch soil-pipe, causes a commotion in the trap, and a pipe of half its area with a discharge from the tank through a 2-inch opening in the tank drew five-eighths of an inch out each time. This discharge was no greater than would come from a bath-tub. The trap was completely siphoned when the outlet was seven-eighths closed, with a discharge equal to three plunger-closets.

When the Vents were closed. — From Number 35 to Number 90. All traps failed from either siphonage or back-pressure. The experiments from Number 35 to 48: The top of the soil pipe was open and the fresh-air inlet closed, in this way submitting the traps to the most severe strain they would have to withstand from back-pressure. Every trap failed except the ball-traps.

Experiments from Number 49 to Number 65 inclusive. The soil-pipe and fresh-air inlet being open were similar to the action traps would receive in every-day use. In every case the traps failed or siphoned, except the Sanitas.

I would call special attention to several experiments, Number 49 to Number 59. The discharge being 15.5 gallons through the 2 inch opening in the tank was hardly as severe on the trap as a discharge from a bath-tub. In every case except that of the Sanitas the traps failed.

In Number 49 a 4-inch trap similar to a hopper-closet trap and a small wash-basin; Bennor's trap, a combination often found in bath-rooms, and a large S-trap were siphoned by a discharge no greater than would come from a bath-tub in a story above. Such traps will always be used, and should never be put in without vent-pipes.

Number 55 to Number 60. Intended to represent a water-closet, wash-basin and bath-tub connection, water extracted from traps at each discharge, and the Bower's trap acting as a vent, the water was taken out to the seal at the third discharge. The wash-basin or bath trap was then partly closed, as would happen in actual use, by the plug, and the S-traps were siphoned by a discharge no greater than would come from a bath-tub in the fourth story.

Experiments Numbers 66 to 71 inclusive, were more severe than such traps would be subjected to, except in unusual contingencies — *i. e.*, the stoppage of the two air-inlets. All failed. These tests were no more severe than ventilated traps were subjected to.

In the experiments from Number 72 to Number 89 inclusive, the siphon action was greater than in actual practice, while the effect of back-pressure would be less, the air confined between the running-trap and the soil-pipe having free escape through the fresh-air opening.

Number 85 to Number 89 show how the air in the soil-pipe was forced through the trap. All the traps failed.

Experiments Number 90 to Number 99 were with discharges into a horizontal pipe on the ground floor. The traps were not affected, although the vents were closed.

Number 94 to Number 95. Water discharged from the tank in the fourth story, blew the water out of the trap.

Back-pressure seems, from the experiments, to be a more important feature in plumbing than is generally supposed. Although the fresh-air inlet was open, the air confined in the pipes almost invariably found egress more easily through traps on second and first floors than through the opening near the foot of the soil-pipe. No trap withstood back-pressure better than the others.

DEDUCTIONS.

(1) The seals of ventilated traps are safe against siphonage and back-pressure.

(2) The seals of unventilated traps are never safe from siphon action or back-pressure, except in deduction 4.

(3) The vertical vent should be three inches, with a four-inch soil-pipe.

(4) Traps connected on a horizontal pipe and fixtures discharging on the same level into horizontal pipe apparently have no effect on unventilated traps.

(5) All varieties of non-mechanical traps are more easily affected by back-pressure than by siphonage.

(6) The ball-traps were not affected by back-pressure, but by siphonage.

(7) The Sanitas trap withstood siphon action better than any of the patent-traps, but was easily affected by back-pressure.

(8) The sewer air is more liable to enter unawares by back-pressure through the seal of the trap, because the seal remains unbroken.

(9) Difference in friction of iron and lead pipes made no apparent difference in the effect on the traps.

The experiments will be continued as to other matters of moment.

Experiments have been made on evaporation of water in traps and the different methods of testing soil-pipes for leakage; but the matter is not yet sufficiently complete to put in this report.

Very respectfully, GLENN BROWN.

[Mr. J. P. Putnam, believing that the foregoing experiments were susceptible of a different interpretation, addressed himself to Dr. Turner, Medical Director U. S. N., in charge of the Museum of Hygiene, etc., where the experiments were made, to such purpose that the surgeon-general has authorized the publication of the following remarks of Mr. Putnam, and has promised that a copy thereof should be sent to every person who had received Mr. Brown's original document. To the unprejudiced mind the true, perhaps the only, way to get at the truth of this much vexed question is not for each investigator to make his experiments where and as he chooses, but for the upholders of the different theories to all meet in Washington, where there seem to be facilities for the work, and after agreeing on what experiments will really test the matter, make them and abide by the results. — EDS.]

THE necessity of enacting suitable plumbing regulations has lately begun to be keenly felt by our legislators and boards of health throughout the country. Following the example of a few large cities the smaller cities and towns are everywhere, in rapid succession, hastening to frame codes of plumbing laws, and the present is a time of unprecedented activity in this direction. Accordingly any measures tending to throw light on the very important subject under consideration, where light is greatly needed, are of the utmost practical value.

The most important question upon which a difference of opinion still exists, to the great confusion of the legislator, is in relation to the desirability of special trap-venting. The final solution of this question will practically turn the scales either in the direction of complication or of simplicity in plumbing. All admit that special trap-venting adds enormously to the complication, cost, and danger of defective work in our plumbing. It is, therefore, evident that it cannot be permissible, unless it can be clearly shown, not only that plumbing *can* be made safe *with* it, but also that plumbing *cannot* be made safe *without* it.

The tests which are now being made by Mr. Glenn Brown, at the Museum of Hygiene, and which have in part been published, form valuable accessions to the data necessary to enable us to decide the question, but have not been sufficient to justify their author in his conclusions. What was needed on his part was a careful comparison of these data with those heretofore obtained by other experimenters, and an intelligent and impartial interpretation of them all. A difference of opinion among investigators, particularly in this field, too frequently arises from a failure on the part of one to study the results obtained by others, as carefully as he should. The consequence is a disagreement on the part of those whose facilities for arriving at the truth are the greatest, and this disagreement not only confuses the public, but throws discredit on the experimenters themselves. I have endeavored, by a careful study of the apparatus and experiments of Mr. Brown, and by a personal interview with their author, to account fully for the difference of opinion existing between us.

I find, first, that Mr. Brown's experiments were made with apparatus and conditions which do not, and, in most cases, could not, exist in practice in plumbing; second, that in his comparisons of different traps with each other different conditions were employed, rendering the comparisons unreliable; and, third, that he has drawn his conclusions from insufficient data, ignoring facts which have an important bearing upon them.

Considering the matter more in detail we are forced to accept the following:

(1) The object of our test is to determine what adverse influences are liable to affect the seals of traps in good plumbing, and how to guard against such influences in the best manner.

(2) The trap-vent pipes used in Mr. Brown's tests are larger and straighter than those used in practice in house-plumbing under the trap-vent law. The pipes used by Mr. Brown were 3-inch, with 2-inch branches to the traps. His drawings are incorrectly made. They show the vent-pipes not more than half the size he actually used, and produce an erroneous impression on the very point under discussion, namely, the efficiency of the trap-vent pipes.

(3) The trap-vent pipes which are used in ordinary plumbing practice, in accordance with the present vent laws, would not be large enough to protect ordinary S-traps, such as were used by Mr. Brown, from the severe tests which he applied to them. We know that the reason why trap-vent pipes often fail in their duty, as they are now made, is because the air is retarded by friction against their walls in passing through them, and that the amount of this friction is increased as the size of the pipe is diminished, and as its course varies from a straight line. Siphonage acts with the rapidity of a flash, inasmuch as it is caused by a falling body of water as it passes suddenly by the mouth of the branch waste-pipe. The air must, therefore, as instantly be supplied, if it is to protect the seal of the trap. This it will certainly fail to do if it encounter any obstructions, such as are frequent in plumbing practice, either in a sharp bend in the vent-pipe, or in too great friction along its walls.

The 3-inch pipes show more correctly the true appearance of the vent-pipes used by Mr. Brown. At the right-hand side of the drawing is shown a trap-vent pipe run in a manner very common in ordinary practice under the trap-vent law. Such venting, even when new, has been shown to be far less effective than the use of a good anti-siphon trap, which, like the Sanitas trap, commended by Mr. Brown, may be made substantially self-scouring, and which has been repeatedly shown by numerous disinterested authorities to be proof against any siphonage that can be encountered in good plumbing practice.

(4) It would be useful to extend the tests at the Museum of Hygiene by using vent-pipes 1 inch, 1¼ inches, and 1½ inches in diameter, as used in practice, and varying in length between 5 and 25 feet. Such tests would then correspond with those made by Messrs. Putman and Rice for the Boston City Board of Health, and with those made at Worcester by the Worcester master-plumbers, in both of which series of tests ordinary traps fully vented lost their seals under siphonage no stronger than that applied by Mr. Brown,

while unvented anti-siphon traps held their seals under the same tests.

(5) Certain forms of unvented anti-siphon traps, including the larger pot or cesspool traps, would be capable of resisting a much more powerful siphoning action than S-traps vented in the manner shown in Mr. Brown's drawing, or as is usual in practice.

(6) Back-pressure may be easily guarded against by simpler methods than by trap-venting, one of which methods is to connect the waste-pipe of the trap with the soil-pipe at a point *beyond* the bend which causes the back-pressure. This can always be very easily done in practice. Another method is to set the trap far enough below the fixture to permit of the formation in the waste-pipe, above the trap, of a column of water long and heavy enough to resist the greatest back-pressure of air likely ever to be encountered in good plumbing. The trap must then be constructed with sufficient water capacity to fill such a pipe. In the experiments for the Boston Board of Health the length of pipe required in the worst cases which could be encountered in good plumbing was found to be from 14 to 18 inches. This method could always be easily applied in practice in places where back-pressure was expected, and the other method was not as convenient.

(7) It would be useful to make the tests last referred to on the apparatus at the Museum of Hygiene.

(8) The tests made by Mr. Brown, which broke the seals of the traps, were powerful enough to collapse and crush out flat the stout lead pipe through which the discharges were sent, so that it had to be replaced by another pipe. Such a fearful suction is evidently much greater than would ever be encountered in plumbing work, and rules for practice should not be based on such severe tests. Such tests are only serviceable as means of comparison between different traps or systems, and care should then be taken to apply precisely the same tests to each trap or system so tested.

(9) The only tests made at the Museum of Hygiene which were powerful enough to destroy the seal of the strongest anti-siphon trap, were those in which the main soil-pipe openings were closed as by snow or ice. Such closure, however, *would be equally, if not more likely to close also the mouth of the trap-vent pipe.* Hence, in those cases, trap-venting would be useless. It would fail, too, in the very cases where it would be most needed. Trap-venting is, therefore, not always relied upon as a safeguard.

(10) Waste-pipes and traps, especially under kitchen and pantry sinks, often become clogged or coated with congealed vapor and grease. Hence the mouth of the vent-pipe, wherever placed in them, must, and does often, become closed by such clogging. Here, again, the vent-pipe is rendered inoperative and unreliable.

(11) The water discharged from the tank in Mr. Brown's experiments was discharged by opening and closing a *solid plug without air-vent,* in the bottom of the tank, only a portion of the water in the tank being discharged at a time. This caused a very powerful suction, so powerful, in fact, that it was found exceedingly difficult at first for the assistant to manage the plug without injury to his hands. This kind of discharge would never occur in plumbing practice, since every plumbing fixture has, and must have, its overflow passage, and this supplies air during the discharge, and breaks the force of the vacuum. A plunger-closet produces an effect nearest in power to this; but the overflow-pipe, though small, is still sufficient to break the vacuum. Now the seals of the traps and overflows of plunger-closets are often destroyed by their own discharges in supplying air to break this vacuum, and the use of this kind of closet should never be permitted in plumbing practice. If the use of valve and plunger closets were prohibited by law the greatest cause of siphonage would be removed.

(12) As is the case with plunger-closets, so it is with other fixtures, such as wash-basins, when constructed, as they always should be, with outlets large enough to fill their traps and waste-pipes "full-bore," their own discharge will often destroy the seal of their traps, provided ordinary S-traps are used. This has frequently been demonstrated by myself and others. Hence, if the vent-pipe be used at all, it should be applied at the crown of the trap to protect it from "self-siphonage."

(13) If the vent-pipe be applied at the crown of a trap, as it should be in the case of S-traps, the ventilating current will rapidly destroy the seal of the trap through evaporation, and the vent becomes again unreliable as a protection against sewer-gas.

(14) Siphonage and back-pressure are supplementary to each other. The greater the power of the one at any place, the less that of the other. They cannot co-exist in full force at the same time and place, but stand in inverse relation to each other. Thus, where at the bottom of a straight soil-pipe just above an abrupt bend back-pressure is strong, siphonage is scarcely perceptible. Hence, in making comparative tests on different traps the same conditions of head and foot vents should be observed. This was not always done in the tests at the Museum of Hygiene, and a much more powerful test was applied to the unvented anti-siphon trap than to the vented S-trap. Mr. Brown's recapitulation should be entirely remodelled, in view of this and the other facts above enumerated. His Deduction Number (1) seems to be contradicted by his Deduction Number (3). For in the latter he admits that the vent should not be less than 3 inches in diameter to be efficacious. In practice they are rarely, if ever, found so large throughout their length. Hence in practice the vent is *not* efficacious.

From the above fourteen considerations we draw the following conclusions:

(1) The seals of ventilated traps are not always secure against the adverse influences liable to affect them in good plumbing.

(2) The seal of a properly-formed anti-siphon trap is secure against such adverse influences when properly placed in good plumbing.

(3) Where trap-vent pipes are large, straight, new, and not too long, they will afford protection against siphonage and back-pressure as long as they remain unobstructed. To make them large enough would involve a greater expense than would be justifiable in view of the result attained.

(4) Back-pressure may be easily and safely provided for by simple means without the aid of the trap-vent pipe.

(5) From the above considerations we conclude that special trap-venting is not desirable, the simpler system being safer and more economical.

I take pleasure in saying that Mr. Brown has consented to make the experiments above suggested on the apparatus, at the Museum, as soon as the weather permits, which will result, as have the tests of many other experimenters, in a further confirmation of the statements made herewith. Very respectfully,

J. Pickering Putnam.

To Dr. T. J. Turner, *Medical Director, U.S.N., in charge of Museum of Hygiene, Bureau of Medicine and Surgery, Washington, D. C.*

ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

PARLOR IN THE HOUSE OF MRS. WILLIAM GAMMELL, PROVIDENCE, R. I.

[Gelatine Print, issued only with the Imperial Edition.]

SKETCHES IN THE HOUSE OF MRS. WILLIAM GAMMELL, POWER STREET, PROVIDENCE, R. I.

THIS house was built by one of Mrs. Gammell's ancestors (Mr. John Brown, a brother of the well-known benefactor of Brown University) A. D. 1786. Situated on the hillside east of the river — at that date it was most probably the farthest removed from the then fashionable quarter, now the old part of the town, at a lower level fronting the river — it was the pioneer of a number of proud family mansions in its vicinity, all more or less enriched with ornament and decorative treatment peculiar to that period. The house in question, built by one of a family of wealthy merchants trading with the Mediterranean and the East, bears the impress of a mind appreciative of foreign taste in art; and is for its size — in plan about fifty feet square, the L being modern — rather lavishly enriched with a number of white-marble busts, imported from Italy, as is also the soapstone mantelpiece in the drawing-room. The rococo ornament is not of so coarse a nature as is frequently to be observed in houses of a little earlier date, and, indeed the woodwork throughout possesses a delicacy and refinement more of the period of the Adams Brothers, though possibly executed in French workshops.

ACCEPTED DESIGN FOR THE ALGONQUIN CLUB-HOUSE, BOSTON, MASS. MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

APPARATUS USED FOR THE EXPERIMENTS ON TRAP-SIPHONAGE CONDUCTED BY MR. GLENN BROWN, ARCHITECT, AT WASHINGTON, D. C.

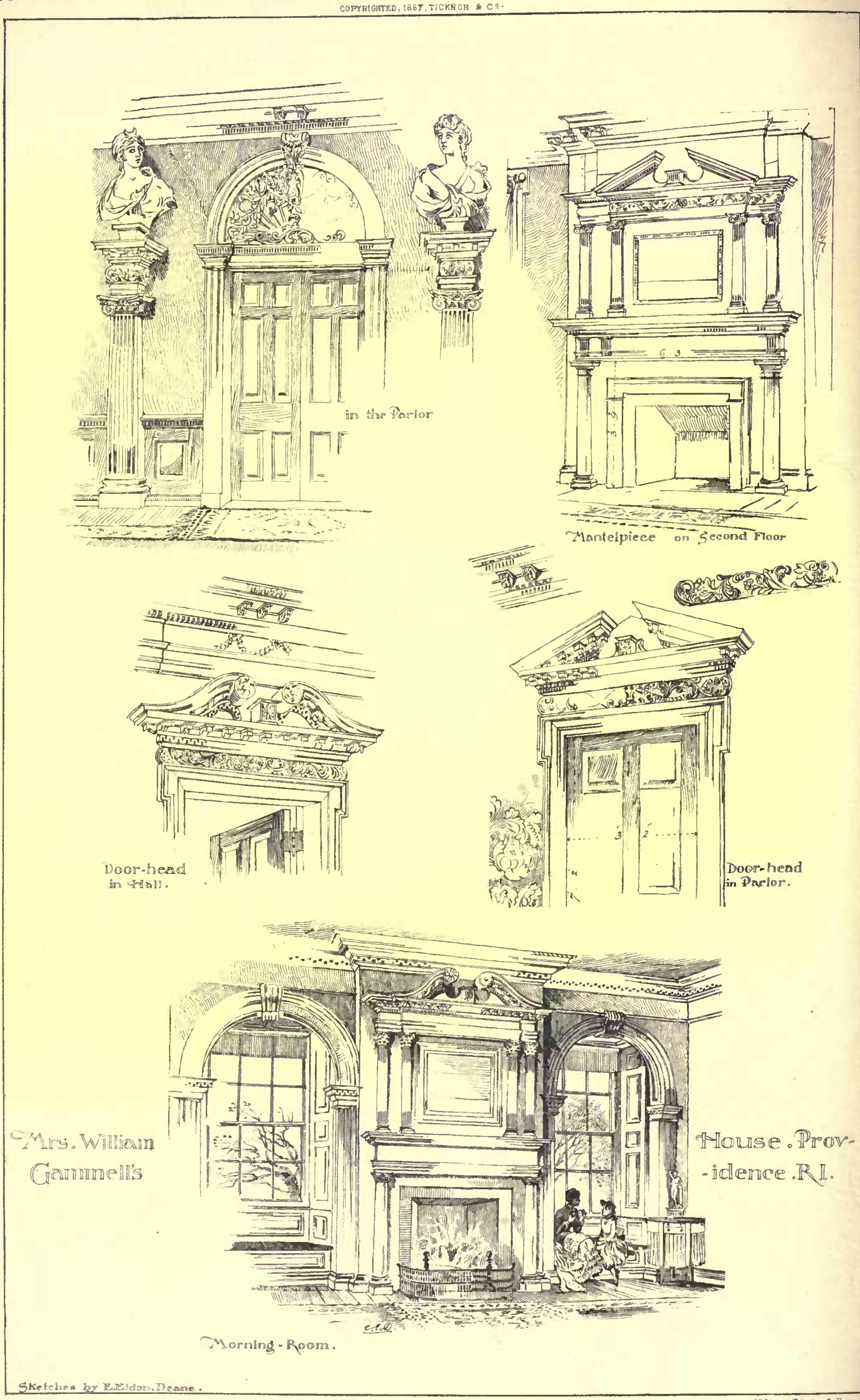
THE TREATMENT OF SEWAGE.[1]—IX.



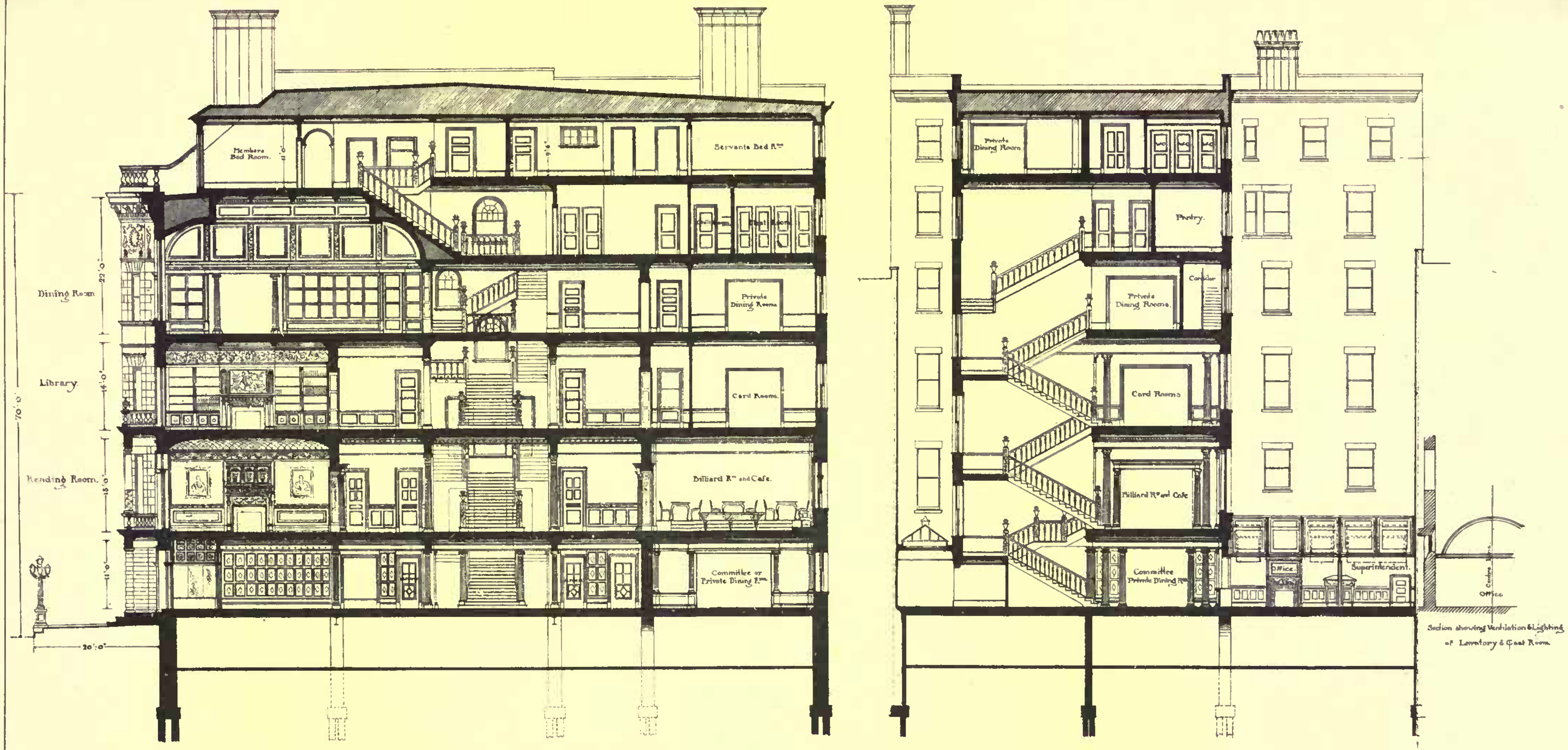
I NOW approach the really practical question, asked all over the country, from every sanitary authority, often in tones of painful despair, viz., "*How shall we deal with our sewage?*"

And here let me say, there is no one answer that can be given to this question. The adviser, to advise fairly, must be prepared to sink his hobby, be it the hobby of precipitation or the hobby of irrigation, remembering that whilst conditions favorable to his hobby may exist at one place, conditions absolutely unfavorable may exist at another. Further, it is of no use telling how some pet plan, say, of irrigation or of precipitation, has succeeded at some one place or another, persuading local authorities to undertake a pilgrimage of inspection (although they are usually ready enough to do) and arguing that

[1] A paper by Dr. C. Meymott Tidy, read before the Society of Arts, April 14, 1886, and published in the *Journal* of the Society. Continued from No. 576, page 20.



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Longitudinal Section.

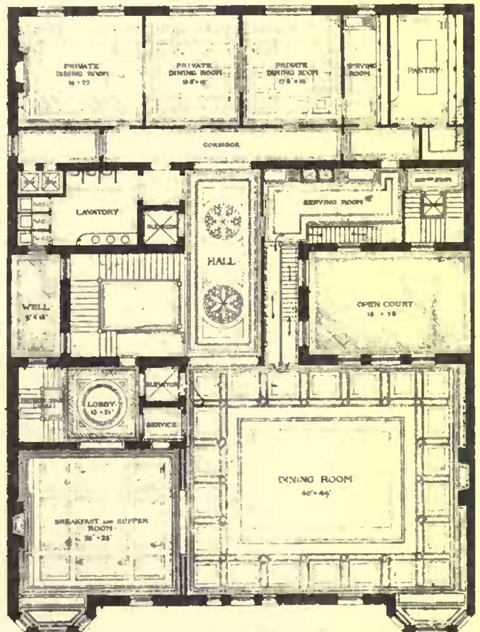
Transverse Section.

ACCEPTED DESIGN FOR THE ALGONQUIN CLUB HOUSE, BOSTON, MASS.

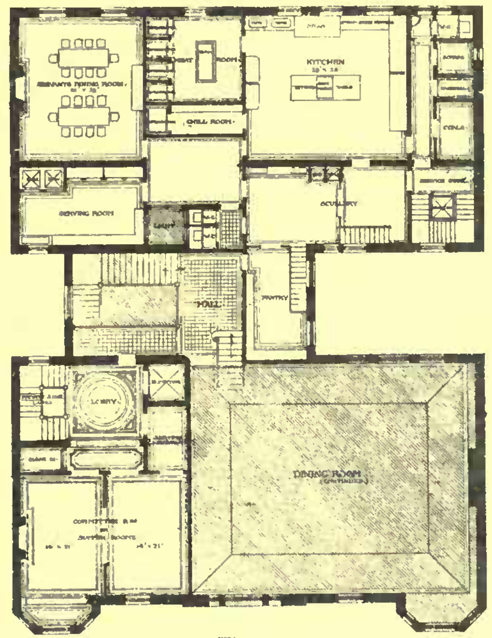
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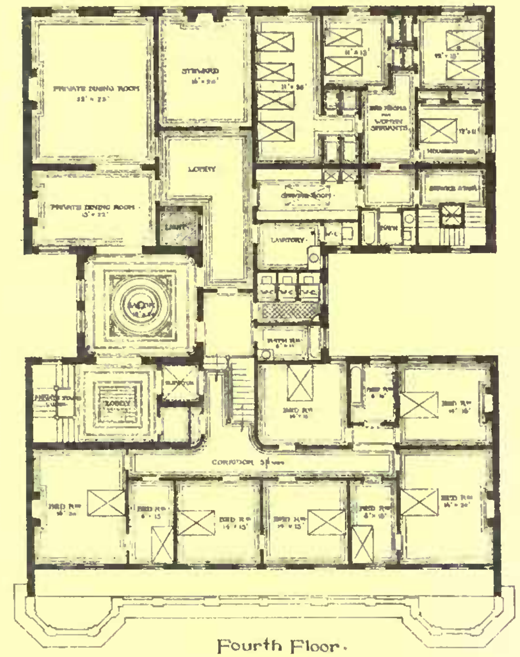
American Architect and Building News, Jan. 15 1887.



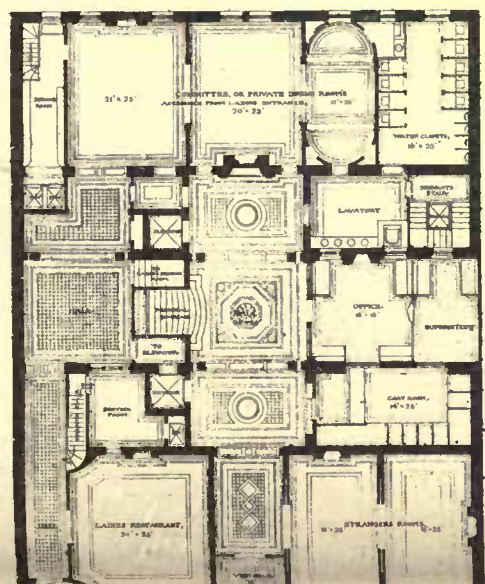
Third Floor.

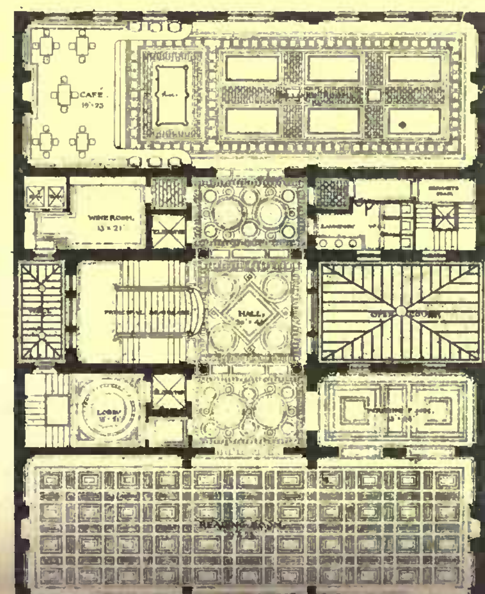


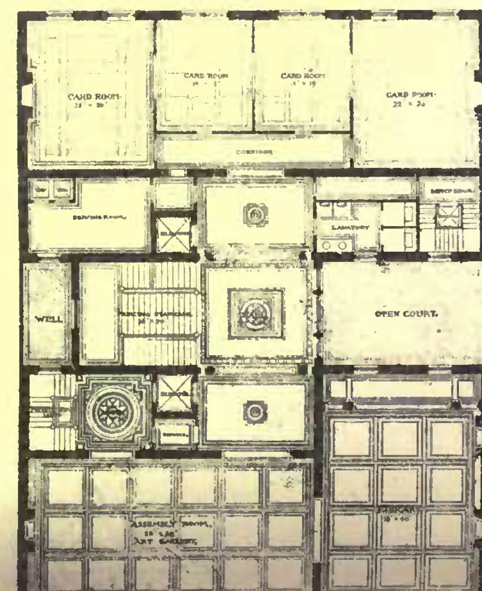
Third Floor. (CONTINUED)



Fourth Floor.





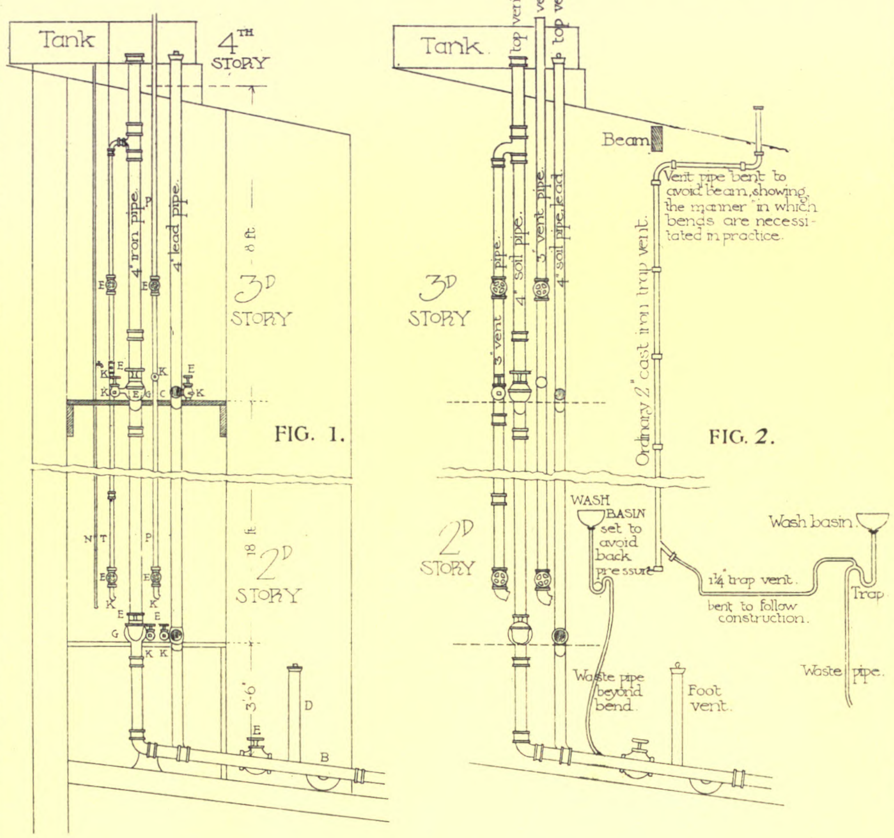


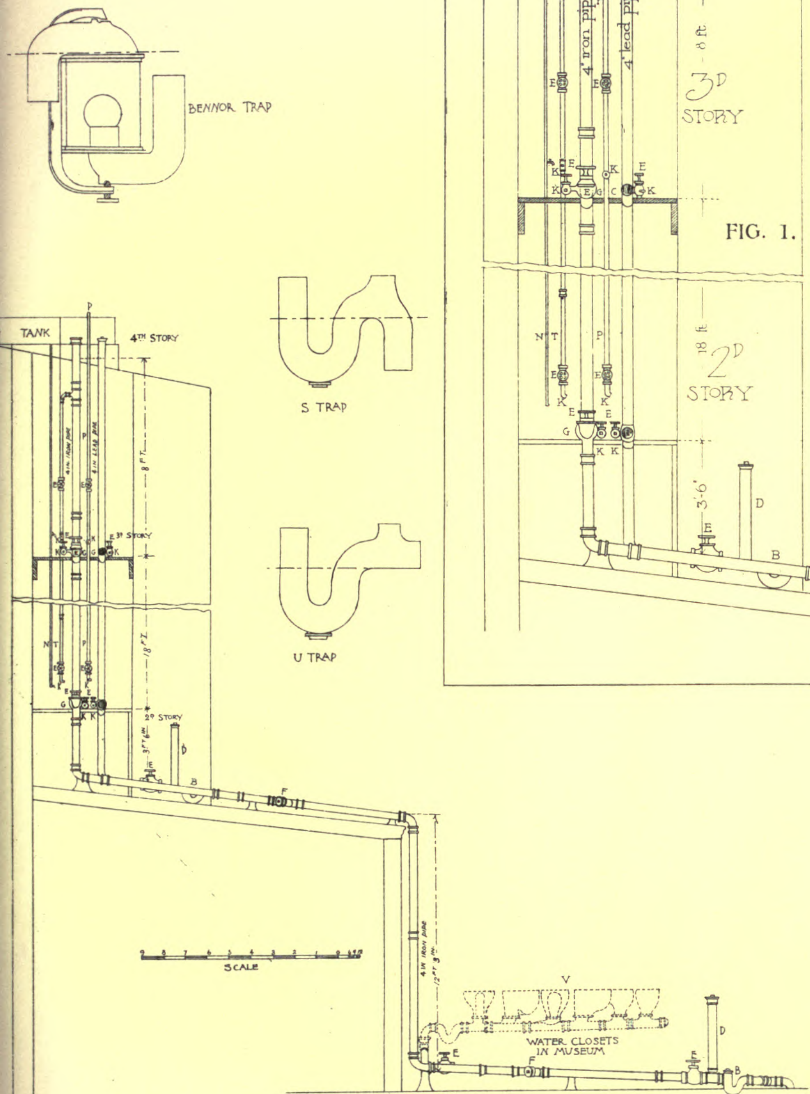


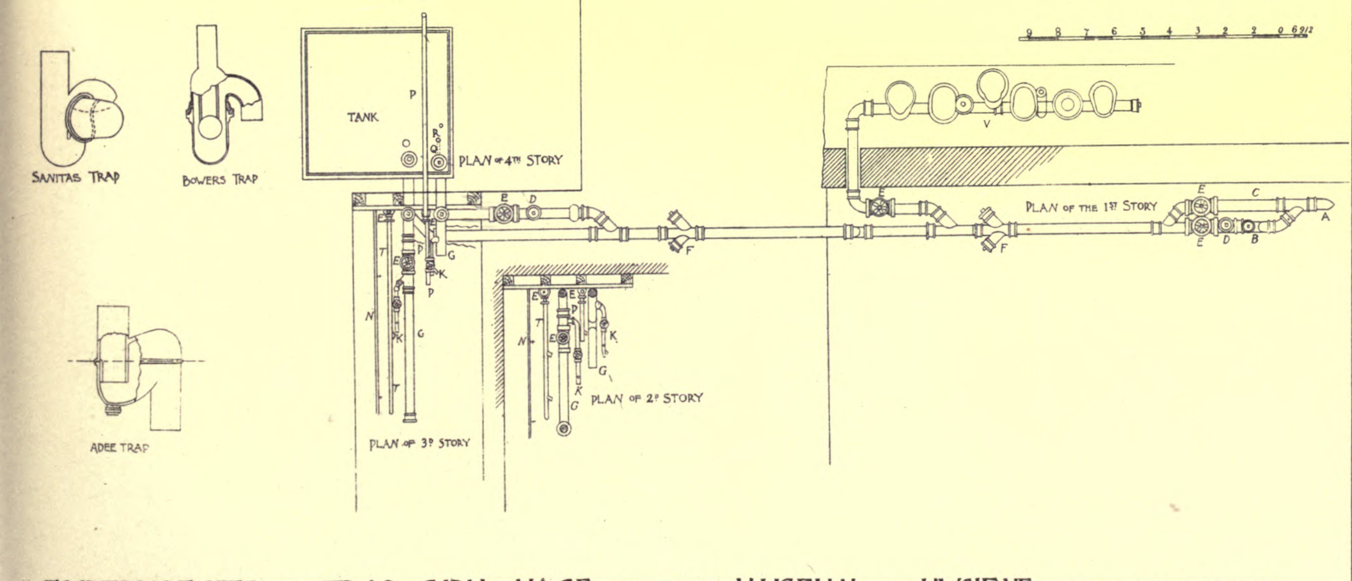
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ACCEPTED DESIGN FOR THE ALGONQUIN CLUB HOUSE, BOSTON, MASS.

DIAGRAM ILLUSTRATING MR PUTNAM'S REPLY TO MR BROWN.







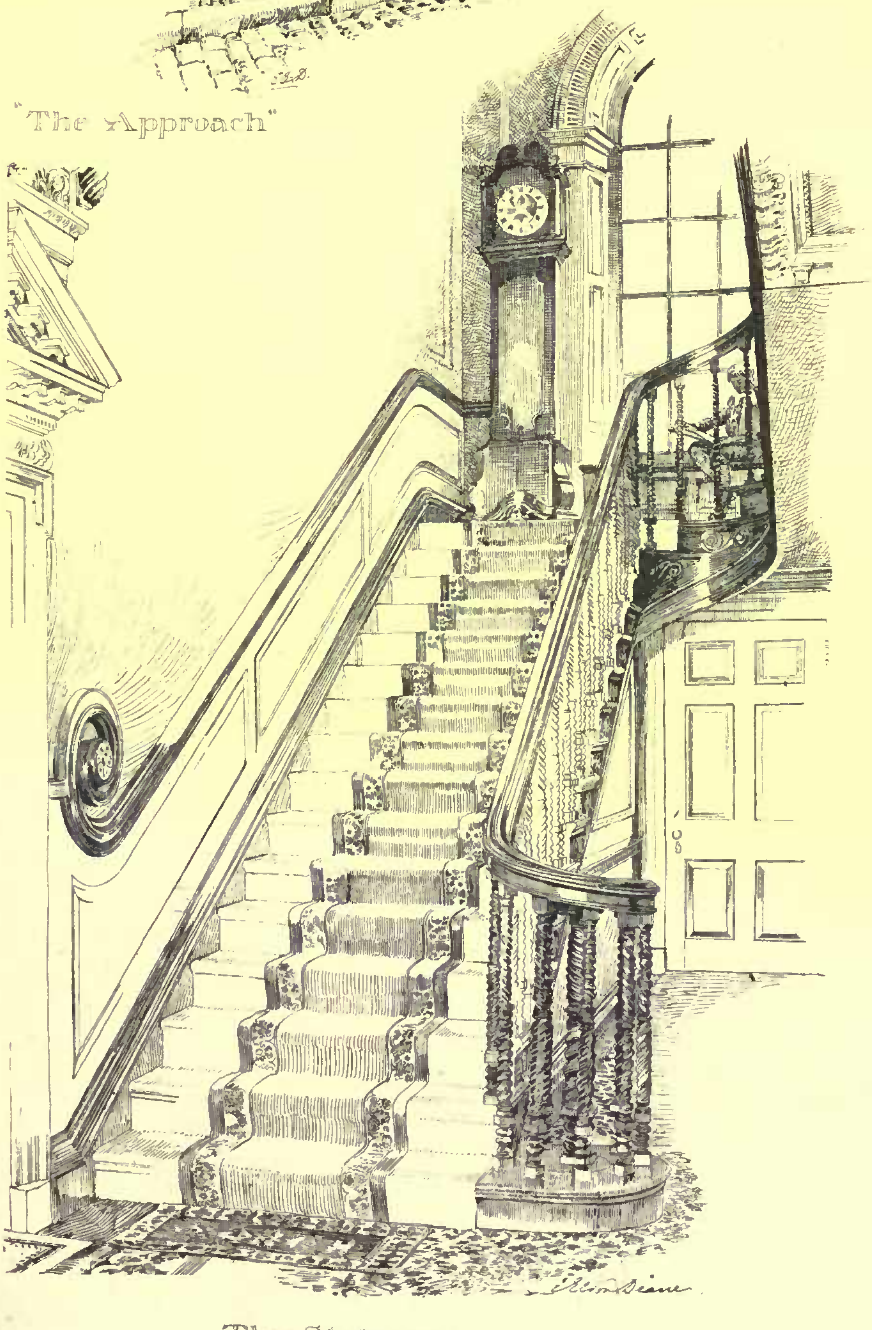
EXPERIMENTS IN TRAP SIPHONAGE AT THE MUSEUM OF HYGIENE, U.S. NAVY DPT, WASHINGTON, D.C BY GLENN BROWN, ARCHT

Heliotype Printing Co. Boston.

Mrs. William Gammell's House. Providence. R: I:



"The Approach"



The Staircase.

Heliotype Printing Co. Boston.

because such and such plan has succeeded at A, therefore it will succeed at B. There is no universal remedy for the sewage difficulty, and no one plan of treatment to be laid down.

When people say, "The whole thing is easy enough, only do this or do that," be certain they have not grasped the difficulties of the subject, and I fear, know little about it.

Let me attempt, however, to suggest certain fundamental propositions that may serve as a starting-point in advising local authorities:

1. Towns must be prepared to pay to be clean. You will never be able to make your sewage pay your rates; on the contrary, experience shows that you must purify your sewage at the expense of the rates.

2. That health demands that your sewage should be got rid of, and purified at any cost. Minimize the cost, but pay you must for purification. Hence, you must be prepared not only to borrow money to erect works, but for an annual expenditure after the works have been erected.

3. That no matter how perfect your works, your sewage will require constant attention, Sunday as well as week-day, night as well as day.

4. That to let unpurified sewage pass into a stream means passing your filth on to your neighbors. Sewage ought to be treated where the sewage is produced, as far as it is possible. And, considering this aspect of the subject, let me add, litigation is a more expensive luxury than sewage treatment, and breeds, if possible (although on this I admit a doubt), more ill-will.

5. That although our duty is to do our work well, at as small a cost as possible, we neither require (*quâ* the effluent) to produce a drinking water, nor (*quâ* the sludge) to produce Peruvian guano.

Our sewage has to be treated. We shall necessarily inquire how much sewage there is to treat, and what kind of sewage it is.

Let me suppose that our first thought is the possibility of an irrigation scheme.

Far be it from me to say that irrigation may not prove successful. But it is fair to note that, to attain the end of a sanitary authority, experience has shown that the sanitary authority must itself be the proprietor of the land. If you give the sewage to the farmers (supposing they would accept your gift) the interests of the local authority and of the farmers are opposite. For it is manifest that the interest of the farmer is his crops, whilst the interest of the local authority is the purification of their sewage. The local authority, as a sanitary authority, must demand a pure effluent at all times, in winter and in wet seasons as well as in summer and in dry seasons. Between these divided interests of farmer and sanitary authority, the question of purity of effluent may, and in our experience usually does fall to the ground. Hence, if irrigation is to be adopted, the local authority must provide its own land for the purpose.

Sundry questions at once arise: —

1. Is it practicable to obtain *sufficient* land, and land *properly constituted* as regards general character, level, etc., for irrigation purposes? Let me note that the word "sufficient" is not capable of precise definition. What is sufficient in the case of one kind of land is insufficient in the case of another. What is sufficient land with one kind of engineering treatment, and with one kind of sewage would prove insufficient with another kind of engineering treatment, and another kind of sewage.

2. Is this properly constituted land reasonably *near* to the town, so that the cost of conveying the sewage to the land will not be excessive, but at the same time reasonably *distant*, so that the town may not derive injury from the nuisance likely (we might almost say certain) at times to result?

3. Is the land of such a level as to necessitate pumping? Is it near a water-course, canal, railway, etc.?

Let me suppose these questions answered satisfactorily. A very serious further question has now to be considered, viz., where is the effluent to be discharged?

The importance of the question is this. In all irrigation schemes, of whatever nature, we are dependent for effective purification on effective land in effective order. The action of land may become ineffective from circumstances over which we have no control, viz., *frost*, where the ground may become absolutely impenetrable, and *water-logging*, in times of heavy rains, when the sewage is in far greater quantity than normal, and for a time at least more foul than normal, from flushing of the sewers.

Hence, if the outfall is into a river where considerable purity, and unfailing continuity of purity is demanded, an irrigation scheme is, to say the least, unsafe. If, however, the discharge be into the sea, or into a tidal estuary, or into a stream, where the occasional discharge of a little doubtful water is unimportant, an irrigation scheme, pure and simple, may pass muster.

To secure land for a sewage-farm (even after the proper land has been found) is not an easy matter. It often means a fancy price. It means, too, a mass of opposition from adjoining property-holders, who suddenly discover that all the fields in the vicinity of the land selected are building ground.

I do not mean this as an objection peculiar to land required for irrigation purposes.

Another matter has to be considered. If land be taken on lease for a sewage-farm, its renewal may prove difficult. The lease of the Croydon farm expires in 1892.

I will at once admit that my own experience has led me to the opinion that greater advantages result from a combined process of precipitation and irrigation than can be obtained by either method independently, admitting as I do to the full, that a good effluent may be obtained by a precipitation process alone, nearly as good, in fact, as any effluent that can be obtained by irrigation. A precipitation scheme by itself has these two enormous advantages over irrigation, viz. (1) its efficient working is totally independent of weather, and (2) that, if sufficiently large works be erected, any emergency of quantity can be met. Precipitation has had its greatest enemies in its most earnest advocates. Extravagant advantages have been claimed for it. The sludge has been advertised as of enormous manurial value. Patents by the hundred have been taken out. Precipitation advocates have been for the most part advocates of a system in which they are interested. And there is no wonder that distrust in precipitation schemes have arisen, when the *claims* put forth by enthusiasts and patent-mongers have been weighed in the balance against the *facts*, and found wanting.

Supposing, then, we determine on a precipitation process, there arises the first great question, *what precipitant shall be used?* Here two points must be considered. At any rate it will not be disputed: —

1. That, consistently with efficiency and purity of effluent, the chemicals should be cheap.

2. That the smallest quantity of chemicals that experience proves is capable of doing the work properly should be added to the sewage, so as to minimize the quantity of sludge formed.

I am anxious to be in no sense the advocate of any one system of precipitation. I will admit, however — the process now is not a patent, and if it were I should speak with greater caution — that the A B C turns out the best effluent with which I am acquainted. My own experience leads me to speak very highly indeed of the combined use of lime and sulphate of alumina. The quantity of lime which is to be added first should be such as to render the sewage faintly alkaline. Probably at the rate of from five to seven grains per gallon will be needed for this purpose. It should be added as milk of lime, and should be thoroughly stirred in by means of a paddle-wheel, or other efficient mixer. A flow of a few yards should now be allowed to permit the aggregation of the precipitate. This having taken place, a solution of crude sulphate of alumina, in the proportion of about five grains of sulphate of alumina, is to be added, and the sewage again actively stirred. In the alkaline condition of the sewage, the alumina will be precipitated, and will then combine with a portion of the organic matter, forming together an insoluble precipitate. Thus treated the sewage should be allowed to flow into tanks for the precipitated matter to collect.

Let me attempt to indicate the effect of such treatment. A portion of the lime will be at once converted into carbonate of lime, by combining with the carbonic acid present in the sewage, and serve as a weighting material to aid in the deposition of the lighter flocculent materials. This mechanical action of the lime carbonate is of great importance. The flocculent suspended matter is no doubt one of the most important materials to remove, because it is that ingredient of the sewage which readily putrefies, and in this way causes a nuisance. It is, moreover, so light that, unless weighted, it is difficult to precipitate. A second portion of the lime combines with some of the organic matter in solution, producing an insoluble precipitate (of uncertain composition) of a compound of lime and organic matter, the subsidence of which is again assisted by the formation of the carbonate of lime previously described. A third portion of the lime renders the sewage slightly alkaline.

The alumina salt is now to be added. The alumina is precipitated, owing to the alkalinity effected by the slight excess of lime. This alumina combines with some of the organic matter in solution, not precipitated by the action of the lime. The power of alumina in combining with dissolved organic matter, and so removing it from solution, is taken advantage of in many commercial processes.

Respecting the iron salts, one strong objection to their use is, that if the effluent be discharged into a river, the stream is liable to be blackened from the formation of a sulphide of iron, a condition likely to be mistaken by the general public for a sewage deposit. I have therefore, of late, admitting the value of iron compounds as precipitants, hesitated to recommend their use, save under very exceptional circumstances. As regards the use of phosphates as precipitants, the effluent is almost certain to contain some phosphoric acid, which greatly aids the growth of low forms of fungoid growths amongst which may be included the so-called sewage fungus.

It is advisable that the effluent, before its discharge into a stream, be at least neutral, and preferably slightly acid. This condition is easily brought about by the addition of a small quantity of acid to the effluent before its escape.

The effluent after treatment, will no doubt have a slight odor. This is not, however, a sewage smell. If in this condition of comparative purity — indicated by absence of color and freedom from suspended matter — it be allowed to flow over and through a small area of land (a loamy sand or gravel by preference) to serve as a chemical filter, high-degree of purity may be obtained, and the finer finishing touches of purification effected.

The evils of irrigation under such circumstances do not arise. Such a filtration of the effluent (1) cannot produce a nuisance, because it contains no foul suspended matters to collect on the surface

and putrefy; (2) it cannot clog the ground, because the gelatinous and *papier maché* matters in solution have been removed; whilst (3) it has a certain manurial value, the quantity of ammonia in solution being not much less than that of the original sewage.

Again I may quote from Dr. Monro's paper, who, it will be remembered, doubts the advisability of ordinary irrigation as a general process, on account of impervious deposits choking the pores of the land. He says, "The removal of the suspended matter, however, from the sewage, renders irrigation much more practicable. With a clear effluent and a porous soil, the nitrifying power brought into play is enormous, and a moderate area of soil, whether of grass land or arable, can deal with large and almost continuous doses of sewage water." Dr. Monro points out that the presence of objectionable organic matter is as destructive to nitrification as the clogging of the soil, or a great lowering of temperature.

The following Table will give some idea of the cost of chemical treatment of water-carried sewage:

Table showing that the Cost of Chemical Treatment of Water-carried Sewage at the outfall varies according to the foulness of the Sewage operated upon, and that such cost is influenced by the number of water-closets in use. It will be observed that water-closets increase the cost of chemicals at the outfall and lessen the cost of cleansing privies, pails, or middens, but that this increased cost of chemicals is less than that thrown on the rates by the cleansing and removal of the contents of privies, pails, or middens.

Name of Process.	Where used.	Population.	Number of w. c.'s in use.	Number of privies or middens, etc., in use.	Quantity of refuse removed yearly from privies, middens, etc.	Annual cost of emptying privies, middens, etc.	Cost per million gallons for chemicals.	Cost per head per annum for chemicals.	Cost per head per annum for emptying privies, etc.	Total cost per head per annum for chemicals and emptying privies, etc.
						£	s. d.	d.	d.	d.
Alumina, iron, etc.	Coventry	42,000	6,000	150	7,000 loads	1,050	19 10	4½	6	10½
Alumina, iron, etc., sewage if dye were absent	Coventry	42,000	6,000	150	7,000 loads	1,050	12 6	3	6	9
Precipitation by lime and coke filtration.	Bradford	197,000	10 ℘ ct.	90 ℘ ct.	56,200 tons	8,000	11 0	2	9¾	11¾
Lime process	Leeds	320,000	13,720	43,000	80,000 loads	12,333	10 9	1½	9½	11

From the above Table it will be seen that if the proportion of water-closets at Bradford and Leeds was larger, the cost of chemicals at the outfall must be considerably increased. If, on the other hand, the proportion of water-closets at Coventry was as low as it is at Bradford and Leeds, the cost of chemicals could be considerably reduced, and would probably not exceed 8*s.* or 9*s.* per million gallons. From this it will be seen that alumina treatment, such as that employed at Coventry, is cheaper than lime treatment; and it has already been shown by official investigations that lime treatment and its modifications are not as efficient as, or equal in sanitary results to, alumina treatment. It is, moreover, still more expensive than is shown in this Table, because of the fact that it produces twice the quantity of sludge as alumina treatment does, the dealing with and disposal of which is a very costly matter, particularly as it is practically useless as a manure, and not so readily saleable as that produced by alumina treatment.

I may be asked what quantity of land is needed where sewage has been efficiently precipitated. Again the answer will depend on the nature of the land. But if I say an acre to every 5,000 to 7,000 people, I am well within the results of my experience.

Sewage works of the kind I have mentioned can be carried out without the slightest nuisance. The mixing should be done in closed wells. The mixture, as it flows into the tanks, should, if sufficient chemicals have been used, be as free from odor, at the distance of a few feet from the mixer, as common water. The land cannot possibly produce noxious effluvia or poisonous vapors, because the sewage has already been treated with antiseptic precipitants.

Of course all depends on the treatment having been efficient. Success in the treatment of sewage obeys the same laws in this respect as success in anything else.

I am desirous here of pointing out certain details of treatment essential for the success of a precipitation process: —

1. It is necessary that the sewage treated should be *fresh* — by which I mean sewage in which active putrefactive changes have not taken place. Perhaps, speaking generally, the sewage should not be more than 48 hours old for effective precipitation. But it is certain that, with a sewage of not more than 24 hours old, a far better result, with a smaller amount of chemicals, can be obtained. In fixing, however, the time, a certain elasticity must be allowed, an elasticity by way of extension in winter and of compression in summer.

I have said the treatment should be effected *before* active putrefaction commences. In sewage, the decomposition of the different constituents takes place at different times, in some cases the periods of active change being separated by periods of practical rest. Thus, a certain alteration in sewage takes place almost immediately. This results (amongst other changes) in the breaking up of the urea, and the formation from it of carbonate of ammonia. It is a rare thing, indeed, for any sewage, when it reaches the sewage works, to contain more than a trace of urea. No nuisance results from this change of the urea. A considerable interval occurs before any other putrefactive stage occurs, and it is during this interval when the precipitation should be effected. If this period be allowed to pass, increased difficulty in working results.

2. The straining of the sewage before treatment, in order to remove rags, corks, and the various *et ceteras*, such as dead rats, walking-sticks, etc., that come down along with the sewage, is advisable but not essential, in order to prevent accumulations on the surface of the tanks. Fixed wire gratings are objectionable, on the ground of their becoming so easily choked. Baldwin Latham's extractor is employed in several places with success.

3. It is essential that sufficient chemicals be employed to effect complete precipitation, disinfection and deodorization of the sewage.

No greater mistake can be committed than to starve the chemicals. To this must be attributed many cases where a precipitation process has proved a failure. A local authority will spend a large sum in erecting works, perfect in architectural detail, excellent for sewage treatment, whilst they shirk a small annual payment for the necessary chemicals. I need scarcely point out that efficient works will not purify sewage. They are but the means to an end. It is better to calculate the amount of chemicals to be used on the population than on the quantity of sewage.

4. It is essential that after the chemicals are added, the mixture should be well stirred. The chemist understands the value of the stirring-rod in order to effect perfect chemical contact. My own experience is that the chemicals added to sewage are often wasted from insufficient stirring. Not only is it the case that they do not precipitate so much as they might, but the process of flocculation is imperfect, and the difficulty of obtaining a clear effluent correspondingly great.

5. It is essential that there should be sufficient tank accommodation. Let me note, sufficiency of tank accommodation is necessary for two reasons: —

(1) That the precipitate may subside perfectly, and leave a clear, colorless effluent. Shallow tanks, with considerable velocity of sewage through them, or insufficient tank accommodation, means imperfect subsidence. Imperfect subsidence means the discharge of a certain quantity of flocculent organic matter in the effluent (the mineral matter being more likely to be deposited from its greater specific gravity), and which flocculent matter is likely to occasion nuisance from its decomposition. The treated sewage should flow through at least two subsiding-tanks in series, the first being capable of holding one hour's flow, and the second not less than four hours' flow. The tanks should be at least four feet deep, and the overflow of the defecated sewage should be over a weir, not more than half an inch below the surface. There should be a double set of tanks for successful working.

(2) Sufficiency of tank accommodation is also important, so that the sludge may be frequently removed, otherwise the freshly precipitated sewage may be contaminated by the decomposing materials of a previous precipitation, or a nuisance result from a collection of decomposing matter. Many a good effluent is spoiled by foul materials being allowed to collect in the subsiding tanks. These materials undergo putrefaction, the gases given off contaminating the effluent. The solid matters, becoming specifically lighter than the liquid, by the gases of putrefaction developed in and amongst them, rise to the surface, the floating black masses presenting an objectionable appearance, and discharging offensive products into the air. After a time these black masses sink, and thus, by constant commotion of the precipitated matters, a turbid effluent, with a more or less foul smell, results.

6. That the defecated water should flow through a shallow open conduit of not less than a quarter of a mile before being discharged into the stream.

7. The stream into which the effluent is discharged should have a free run, and in volume be not less than eight times the volume of the defecated sewage.

8. That the tanks themselves should not only be emptied of the sludge, but thoroughly cleansed before being refilled.

The extent of tank accommodation needful will depend a good deal on the dilution of the sewage to be dealt with, either by subsoil or surface waters, or by both, and whether the treatment employed be intermittent or continuous. The following gives the tank capacity provided at certain successful works: —

Precipitation Tank Capacity.

Place.	Treatment.	Population.	No. of tanks.	Capacity in gallons.	Gallons. per head
Bradford.	Intermittent	200,000	34	612,000	3.06
Coventry.	Intermittent and continuous	45,000	8	1,000,000	.22
Hertford.	Continuous	7,747	6	318,000	.41
Leyton...	Continuous	40,000	4	1,000,000	.25

The most suitable depth for tanks is from five to six feet.

It may be worth noting the rate at which the precipitated matters deposit when the treatment with lime and sulphate of alumina is efficient, and the sewage collected in tanks of 5 feet 6 inches. The water begins to clear a few minutes after the cessation of agitation. In thirty minutes it clears to a depth of 3 feet, with 8 inches precipitate, while after two hours the precipitate will measure 4½ inches only.

All this accomplished, two questions remain: (1) Have you produced such an effluent that it will not pollute the water-courses? (2) Is not the sludge certain to cause a nuisance?

That a clear, colorless, non-frothing effluent can be produced by mere chemical precipitation, is not a matter of opinion but of fact. That an effluent absolutely without smell can be produced, I doubt. The smell, however, of the effluent from properly treated sewage is not the odor of sewage. I have never, I candidly confess, found an effluent without a certain smell. I have heard a well-known authority ascribe it to the presence of minute traces of essential oils or strong-smelling bodies (*e. g.*, onions), difficult of removal by precipitants. If the effluent is to be discharged into the sea, or into a tidal or large river (say two hundred or three hundred times the volume of the effluent), this odor is absolutely immaterial; but where great purity is required, *e. g.*, when the effluent has to be discharged into a small stream or into a river employed at a short distance from the outfall for drinking purposes, some further treatment is called for.

Such further treatment consists either (1) in the use of artificially prepared filter-beds, such as are used for the filtration of water, or (2) by filtration through a small area of land.

Of these two methods, I prefer the latter. After careful consideration, I consider that for this purpose an acre to every 5,000 to 7,000 people (as I have before noted) is abundant. I shall not discuss any question of manurial value, although I may point out that the ammonia of sewage is not appreciably affected by ordinary chemical precipitants.

(2) Is not the sludge an inevitable cause of nuisance? I confess it may be, and often has been. Allowing the sludge to accumulate week after week in the depositing-tanks, is not only an evil (as I have pointed out) so far as our endeavors to procure a good effluent is concerned, but an unmitigated nuisance, so far as relates to the sludge. Further, the old method of emptying the sludge into open sludge-pits, where the liquid portion was allowed to drain away and to evaporate, has proved a constant cause of just complaint, more especially in warm weather. I am not sure whether the sludge, under these conditions, was not sometimes a greater nuisance after being taken out of the sewage than when left in it. Until lately the difficulty of the disposal of the sludge was one inherent to all precipitation works. Until lately, I said, because now the difficulty is overcome.

I am indebted for the following table to the manager of a sewage works in a residential neighborhood of a population of 18,000. The process used is lime and sulphate of alumina. The sewage is pressed in one of Johnson's presses: —

Sludge.	Amount per day in tons.	Amount per annum in tons.	Amount per million gals. of sewage in tons.	Amount per million gals. of sewage proper in tons.	Am'nt per head of population per annum in cwts.	Cost per ton.
Wet ...	33.75	12,319	44.53	67.5	13.7	10d.
Pressed	6.04	2,205	8	12	2.45	4s. 7d.

The record of sludge begins on February 16, 1885, and ends on February 16, 1886. The wet sludge is got by a series of eighty different actual measurements on various days throughout the year. The pressed sludge is got by keeping a record of the number of times the presses were emptied on every day in the year. A cubic yard of wet sludge is taken as weighing .98 of a ton, and a cubic yard of pressed sludge as weighing .75 of a ton (actual determinations).

The following details are taken from Mr. Lacey's Report to the Brentford Local Board, on "The disposal of Sewage Sludge":

THE DISPOSAL OF THE SLUDGE AT VARIOUS TOWNS.

I. Left to dry in open pits and given or sold to farmers.	II. Run on land, or dug in and deposited.	III. Mixed with house refuse and given to farmers, or used on own land.	IV. Partly air dried, and burnt in kiln.	V. Dried, and made into cement.	VI. Pressed in filter presses.	VII. Mixed with house refuse and burnt in destructor.
Atherton, 12,602* Bacup, 25,054 Burton-on-Trent, 41,500. Chester, 37,000. Ely, 8,171 Derby, 89,690. Leicester, 130,000. Luton, 28,000. Over Darwin, 36,000. Twickenham, 13,200. Taunton.	†Birmingham, 605,000 Redditch, 10,500. Royal Leamington Spa, 24,000. Walthamstow, 30,000. Windsor, 12,500.	Epsom, 8,000. Northampton, 55,000. Wellingborough, 14,000.	Salford, 180,000	Burnley, 68,000.	‡Croydon Rural, 25,000. §Coventry, 47,000. ‖Leyton, 38,000. ¶Wimbledon, 20,000. **Chiswick.	Ealing, 18,000.

* The number after each town is the estimated population.
† 479 cubic yards daily; 1 acre of land used weekly; treatment repeated every third year.
‡ Sold at 1*s.* 6*d.* per ton.
§ Cost of pressing per ton of cake 2*s.* 6*d.* Sold at 2*s.* 6*d.* per ton.
‖ Cost of pressing per ton of cake 1*s.* 8*d.* Cleared free of cost.
¶ Cost of pressing per ton of cake 3*s.* 6*d.* to 3*s.* 9*d.* Sold at 1*s.* per ton.
** Cost of pressing per ton of cake 3*s.* 4*d.*

It is essential, both in the interests of the effluent and of the sludge, that it should be frequently removed from the tanks — I mean that the sludge should be removed before putrefactive decomposition sets in. This frequent removal is necessary (1) so that the effluent may not be polluted, and (2) so that no nuisance may result during the removal of the sludge and the cleansing of the tank. For here I must express a strong opinion that it is not enough merely to empty the tank of sludge, but it is imperative that, after being emptied, and before being refilled, the tank should be well cleansed; in other words, that the matters which stick to the sides of the tank should be completely and efficiently removed, to prevent nuisance or fouling by subsequent decomposition.

It would be outside my province to deal with the methods of raising the sludge out of the tanks. This is a purely mechanical question. The sludge is a thick black liquid, which may be pumped out of the tanks or lifted out by bucket-pumps into troughs, which serve to convey it wherever it may be wanted.

It will be convenient at this point to consider the amount of sludge produced, its value as a manurial agent, and the methods suggested for its disposal.

[To be continued.]

CINCINNATI WORK IN 1886 AND 1887.


Cape Cod. Mass. A Bit of old Provincetown.

THE architectural year of 1886 has passed out of existence, and, whatever of good or evil that has been done during the year has been left as a "guide unto our feet and a light unto our pathway." Let us but hope that during the coming year even more good and even less evil may be accomplished because of the lessons it has taught.

It is a difficult matter to ascertain, with any degree of accuracy, just how much building has been done in Cincinnati during the year, as the laws now in existence in regard to building permits are somewhat lax: but the records kept are for the present the best we have, and as a basis of comparing one year with another is perhaps a great deal better than nothing; and so we give the number of permits and the total cost of building operations during the past four years, with the advice that it will be safe to multiply by two in each case: —

Year.	Total permits.	Total cost.
1883	773	$2,670,000
1884	774	2,958,000
1885	872	2,145,000
1886	609	2,847,000

It will be seen by comparing the above table that 1886 has held its own, notwithstanding the strikes of last spring, which seemed for a while to tear things wide open and upset the calculations and hopes of builders for a prosperous year. There can be no doubt but that, had the strikes not occurred, there would have been perhaps forty per cent more building, and the strikes, coming as they did in the early spring, when they were not expected, threw building matters into confusion and knocked out two of the best months of the year. However, even those difficulties were overcome, and from present appearances there are no mutterings of any similar strife, and everything now points to a busy season, as things go here.

The journeymen bricklayers have set wages for the coming season at fifty cents per hour, and nine hours to constitute a day's work; this is an advance of five cents per hour over last year, but it will make no practical difference in brickwork, as the prices of brick are lower than last year.

The limestone masons have not yet set the price for their labor, but it will probably be forty-five cents per hour and nine hours to the day. The result will be the same as with the brick masons; that is, labor will be higher but material will be lower, thus making the price per perch about the same as last year.

The freestone cutters and setters have about agreed upon a price for labor which will be satisfactory to all parties concerned, and as no trouble is anticipated in other departments, it may be set down almost as a certainty, that we will be saved a repetition of last season's set-backs.

An important event in connection with the building interests of the city is about to be inaugurated, in the shape of a Permanent Building Exhibit similar to the one in Chicago. The matter has been undertaken by the architects and builders, and promises to be a great help to all persons connected with building houses.

The Cincinnati Chapter of Architects have, during the past three months, been engaged in revising the Building Law that was prepared a year ago, under the sanction of the Builders' Exchange. The Chapter's chief endeavor was to cut the bill down, as it was entirely too large, and in many cases it was inconsistent. The labors of the Chapter have just been completed, and the result is to be submitted to a joint conference of architects and builders, after which it will be ready for the Legislature.

Coming more directly to architecture, the Art Museum on the hill overlooking the city has been completed during the year, at a cost of some $300,000. It is a fire-proof building, in native limestone, with granite trimmings. The designs were published in the *American Architect* for January 9, 1886. Just alongside of the Art Museum,

another building to be used as an art school is now in course of erection under the same architect, J. W. McLaughlin; the walls of this building are now up, the roof-trusses in place. The cost will be about $80,000.

The court-house (also by Mr. McLaughlin) has been finished and lately occupied by the various county officers. It will be remembered that this building was destroyed by fire two years ago this next March, and it seems as though a good piece of work has been done in a short space of time. This is about all of the public work that has been done during the year.

Of the store work, most has been done by Mr. Hannaford, and, while all of them are good, it will not be out of order to state that it does seem as though Mr. Hannaford is getting too much iron into the fronts of his building, and it may not be long until the iron manufacturers will be doing what they did some fifteen years ago; *i. e.*, repeating store fronts from old patterns without the aid of architects. Without exception they all have two stories of ironwork, and the last one (H. and S. Pogue, on Fourth Street) is all of iron, and while it is good, yet there may be nothing to prevent another one from the same patterns being put up anywhere else without the usual commission of five per cent being paid the architect.

Of the stores referred to as having been put up by Mr. Hannaford, there is the row of six on Fourth Street, between Central Ave. and John, for the Goff Estate; one for John Simpkinson, one square farther up on Fourth Street; and one nearly opposite, for Mr. H. W. Derby, which also goes around the corner and has a similar front on Central Avenue. The three stores corner of Fourth and Elm Streets, 100′ x 150′, were completed early in the year; one for Louis Seasongood, on Sixth Street, near John, and others might be mentioned.

The United Bank Building, by H. E. Seiter, corner of Third and Walnut Streets, is of pressed-brick and terra-cotta, and is a pleasing innovation on the style of mercantile building that has been the rage here for years. Of the prospective buildings for the coming spring, another letter had best set out the number and merits. C. C.

BOOKS AND PAPERS.

FORTUNY.[1]

SPAIN has never been famous for the number of its great artists, but when a native of that sunny land is born with the divine fire his genius does not fail to develop like the luxuriant flowers of his own Andalusia, blossoming out with a dazzling brilliancy, which throws all lesser light into shade, rising to the utmost possibilities of art almost at a bound, disdainful of critics and academies, an artist *sui generis*. Such was Murillo, and in our own time such has been Mariano Fortuny.

Any one to whom it has fallen to be beleaguered in a small Spanish town can appreciate the thoroughly inartistic character of Fortuny's early surroundings. He was born at Reus, a few miles from Tarragona, June 11, 1838. His parents were poor, and his education was limited to what he received at the village school, poor enough at the best; but a boon to him for the little drawing mingled with the grammar and arithmetic. He drew by instinct, and his attempts having attracted the attention of a local art patron, the young genius was given a palette and brush, and taught how to use them. When the boy was twelve years old, he lost his father and mother, and fell to the care of his grandfather, by trade a joiner, who added to his small wages by exhibiting a small collection of wax figures, which the old man modelled and the future artist covered with color. When Fortuny was fourteen, the grandfather and the boy went to Barcelona to seek their fortunes. They were still so poor that the whole journey was made on foot. Fortuny's fortune came first in the shape of a native sculptor, who took an interest in the boy, and succeeded in obtaining for him a pension from the city of eight dollars and forty cents a month. Upon this munificent bounty, Fortuny was enabled to follow the courses at the Academia de Bellas Artes in Barcelona, and with such success that at the age of nineteen, he won the Prix de Rome. At Rome his progress was no less rapid than in Barcelona, though his work of that period shows that he had not yet appreciated the true bent of his genius. Two years later it was revealed to him under most striking circumstances. Queen Isabella declared war against Morocco, and in the patriotic anticipations of an easy conquest, Fortuny was summoned from Rome by the city of Barcelona, and commissioned to accompany the local volunteer corps to the land of the Moors, in order to fitly represent their deeds of valor in a huge painting for the town-hall. The expedition departed, and for six months Fortuny was in a painter's paradise, observing every thing, noting the thousand wonderful effects of poetic color, which cling about Arab life and architecture, fascinated by the wild charms of the Moorish civilization, the horses, the curious types, the rich stuffs, the arms, and the strange costumes of the black soldiery. One day the emperor of Morocco came in all the splendor of his sumptuous array, and Fortuny's pencil flew only less rapidly than his imagination. Indeed, the civil life of the Moors, the picturesque episodes, and the dazzling bits of color and detail so won the heart of our painter, that the historic battle-piece was neglected or forgotten, and the only return Barcelona ever received was a huge, empty canvas. Fortuny's genius did not lie in great compositions. Dazzled himself by a new revelation, his mission henceforth was to dazzle others by his art. He struggled manfully with his task, however; took the huge canvas back with him to Rome, painted at it and about it, and did all he could to redeem his pledge to the city which had given him an art education, solacing himself between times with bits of art in his own true vein — brilliant water-colors, Moorish interiors painted as only Fortuny could paint them, besides a few more important paintings wherein his fancy had full freedom to introduce all the rich, transparent tones and wonderfully-executed accessories which are so characteristic of his style. It may be of interest to note a fact not mentioned by his French biographer, that one of the first art amateurs to seek out and appreciate Fortuny's talent was an American, Mr. W. H. Stewart.

By 1866, Fortuny was beginning to have a more than local reputation. His name was spoken in Paris, and Goupil agreed to take a certain number of water-colors at one hundred francs each. In the autumn of the same year he went to Paris, being then twenty-eight years of age, and spent some time studying under Meissonier and Gérôme. Fortuny was by nature an exact draughtsman when he cared to be, but his studies under these masters made him appreciate more fully the small values, and helped him greatly in his technique. The next year he married the daughter of Madrazo, the Spanish court painter, and by his marriage came into possession of quite a snug little fortune, which permitted him thereafter to be entirely independent. He returned to Rome with his wife, and established his studio there, soon creating a reputation for his works, which were beginning to bring high prices in the artistic world; and drawing about him a coterie of artists, all eager imitators of his style, and all enthusiastic admirers of his extraordinary genius. It was about this time that he made the acquaintance of Henri Regnault: the correspondence of the author of the "Salomé," shows how strongly he was impressed by the works of the Spanish painter. "*J'ai passé avant-hier la journée chez Fortuny et cela m'a cassé bras et jambes. Il est étonnant ce gaillard-là! Il a des merveilles chez lui; c'est notre maître à tous.*" But outside of a comparatively restricted circle, Fortuny was then almost unknown. He cared little for mere renown, was of a retiring disposition, had now no need of patronage, and those who would know him were obliged to seek him out. In 1870, he exposed at Goupil's his "Spanish Marriage," which created quite a furore among artists, and prepared the way for his chef-d'œuvre, "The Choice of a Model," which appeared shortly after. This painting, the gem of the Stewart collection, established Fortuny's reputation incontestably, and confirmed the considerable prices that had been put on his works.

From 1870 to 1872, Fortuny lived in Grenada among the bewitching loveliness of the Alhambra. There he was at his best. All the thousand and one diversified beauties of that dream-like Moorish palace found a ready echo in his mind, and a sure interpreter in his pencil and brush. It was in the gardens of the Alhambra that he for the first and almost the only time in his life painted something which was more than a reflection — something which showed thought, as well as talent — the "Rehearsal of a Tragedy in a Garden;" a wonder setting of a luxuriant Moorish garden about a few figures simply and effectively posed; a painting impossible to describe to one who has not seen it; but showing Fortuny at his best in many ways.

In the spring of 1874, he established himself near Naples, and made a quantity of enthusiastic studies. In November he made a visit to Rome, and had an attack of fever, which he succeeded in overcoming; but an after attack took him unawares, and he died the 21st of November, 1874. He was then thirty-six years of age.

The influence of Fortuny has been very widely felt. Endowed with a wonderful natural ability as a draughtsman, without wishing it he created the school of the hand, and established a precedent which has led many a young artist, less richly endowed naturally, into weakly copying his delusive style. Fortuny's real science added to an incontestable charm that every one admits, his love of light and sunshine, a certain unexpectedness in his choice of subjects in his ideas and in his technique, gave him his reputation, and it was a legitimate one. But he astonishes more than he moves. One can not but feel that the greater share of his works have been inspired by the accessories grouped in them, and that like Gilbert and Sullivan's operas, his paintings were first made and then named. For instance, in "The Choice of a Model," the beautiful hall of the Palazzo Colonna at Rome had evidently tempted him, and he had reasoned that the scene which would best suit such an interior would be that embodying a display of elaborate costumes in opposition to the figure entirely nude. For the "Spanish Marriage," he perhaps saw some beautiful sacristy such as exist in Spain and Italy, and said to himself that the signing of the act of marriage in the last century would be a group best calculated to show off such architecture. He executed with a rapidity without equal; but his very mastery of technique — or was it a deeper appreciation of the value of opposition by contrast — led him sometimes to slight one portion of a figure while another would be finished with microscopic exactness; he would even leave the surface of his canvas or paper to give all the effect, and with most surprising results. M. Yriarte tells of one of his most successful water-colors, which was made on a piece of paper

[1] "*Les Artistes Célèbres, — Fortuny:*" par Charles Yriarte, Inspecteur des Beaux-Arts.

that had been half-burned and scorched over with odd spots. Fortuny saw in it a background all ready prepared, and without any thought of performing a feat of artistic gymnastics, accepted it as so much help towards the finished picture. But though he very early in life made up his mind about the kind of work he wanted to do, his genius was by no means fully developed at the time of his death, and he evidently appreciated the fact himself, for as late as October, 1873, he wrote to a friend, "To-day, I have no debts, I have even something put by, and my independence is assured. I am now only beginning to do what I feel, and what pleases me."

Into what Fortuny might have developed had his life been spared, it is impossible to say; but his artistic character as he left it can be well summed up in M. Yriarte's words, "*Véritable charmeur, plein de séductions, qui visait aux yeux et nous éblouissait.*"

JOHNSON'S SURVEYING.[1]

WHILE books on engineering science, as applied to construction, drainage and water-supply, follow one another rapidly from the press, the subject of surveying continues to be taught, in most technical schools, without further aid from text-books than such as can be obtained from works which treat of methods of practice, and of instruments and appliances, which have for years been replaced by better ones, while the scope of most of them is restricted to land-surveying alone. By lectures in the schools, and by practical experience and the reading of the professional journals, the young engineer is able to make good in some degree the deficiencies of text-book literature, but at a serious loss of time, and Professor Johnson has done a service to the science, as well as to those who wish to study it, by collecting in one compact book, clearly and concisely written and well arranged for students' needs, a treatise on the modern art of land-surveying, with all its important extensions and applications, in the form of topographical work, railroad, hydrographic and mining surveying and geodesy, to which are added special chapters on city practice, on topographical drawing, and on earthwork, and some useful appendices on the judicial functions of surveyors, on the instructions to the United States deputy mineral surveyors, with tables of trigonometric formulæ, four-place logarithms, natural sines and tangents and others, and an isogonic chart of the United States, showing the average variation or declination of the compass for the year 1885 at all points. Notwithstanding the comprehensiveness of the book, it is extremely practical. To use the author's own words, the problems of the old text-books on surveying whose only claim for attention is that of geometrical interest have been omitted, to make room for descriptions of improved methods or apparatus. In the latter respect, particularly, much new matter is to be found, and it may be supposed that a work which describes and explains, both theoretically and practically, all the principal forms of suspended and rolling planimeters, the Saegmuller solar attachment to the transit, and the heliotrope as applied to geodetic work, leaves nothing to be desired. In the discussion of methods applicable to particular classes of investigation, Professor Johnson has not trusted to his own experience, but has enlisted the services of specialists to make his book more valuable, calling upon Mr. William Bonton, the City Surveyor of St. Louis, for the chapter on City Surveying, on Mr. C. A. Russell, United States Deputy Mineral Surveyor at Boulder, Colorado, for the chapter on Mining Surveying, and on Justice Cooley, of the Supreme Court of Michigan, for the admirable Appendix on the Judicial Functions of Surveyors.

WE have received from M. Rouam, the well-known Paris publisher, the first two volumes of what appears to be a most excellent book of reference in a "*Dictionaire des Marques et Monogrammes de Graveurs*," by Georges Duplessis and Henri Bouchot. Both of these gentlemen are of the staff of the Bibliothèque Nationale, M. Duplessis being keeper of the prints. The volumes which we have comprise the letters A to O inclusive, are of 16mo size and finely printed on hand-made paper. They include the distinguishing devices of the engravers from the earliest times of the art to the present day, and form part of a series of "*Guides du Collectionneur*" now being issued by M. Rouam.

COMMUNICATIONS

ADVICE TO STUDENTS.

LEWISTON, ME., December 28, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you please advise me, through your column of communications, which of the following methods of study would, in your opinion, be of the greatest advantage to one who has already spent three years in an architect's office, and has acquired a fair knowledge of construction and designing of the less complex work: —

1. A six months' trip through England, France and Italy.

2. The same length of time spent in study at the School of Fine Arts, Paris, or

3. The same length of time spent at the Massachusetts School of Technology, studying the theoretical part of architecture, which one does not get in an architect's office. Yours, E.

[UNDER the circumstances it seems to us that the first scheme promises the best results, if the trip is made seriously and not for amusement, particularly if, besides sketch-books, one or two manuals of construction, of history, or whatever else, are packed up for use in evenings and rainy days. In Paris our correspondent should enter some of the evening drawing classes, and should consult libraries, besides doing the usual amount of sight-seeing, and in London he should time his trip so as to be able to attend a course of Architectural Association or Royal Academy lectures. — EDS. AMERICAN ARCHITECT.]

MONMOUTH, ILL., December 3, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — An architect, of whom I inquired what institution he would recommend as the best in which to obtain architectural training, referred me to you, as he was educated in Germany. Would you kindly do me the favor to answer the question. And also, is it customary or desirable to work in an architect's office before going to a school? I graduate from Monmouth College this spring.

Respectfully, D. E. WAID.

[IT depends largely on temperament whether office-work before study is beneficial or prejudicial to the student, and his desire to become a designer or a constructor must also be reckoned with. A student who, after a year or two in an office, seeks instruction in design, often finds himself embarrassed by his knowledge of merchantable sizes and the methods in vogue in the office of his former employer. The result usually is that his designs are thin and meagre, although they can unquestionably be built. On the other hand, the student who becomes a facile designer, according to the academic methods, is often annoyed, when he first undertakes to handle actual building operations, to find that it is far from an easy or obvious thing to build what he has so effectively designed. Still as proper instruction will diminish this evil, we incline to think that the best and natural course for one who proposes to design that which he is to build is to receive his instruction in design before he enters on practical every-day office-work. If the student can spare time to take the full course at Columbia College, New York, we advise him to take that course: if he cannot spare the time, a special course at the Institute of Technology, Boston, is the best thing for him. —EDS. AMERICAN ARCHITECT.]

EATON, OHIO, December 30, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — The enclosed letter from Mr. G. will explain my application to you, and in accordance with his advice I will state the case to you as short as possible.

I am a carpenter by trade and follow building, and have erected by contract a number of public and private buildings, and am fairly well informed on all that relates to the material or labor required in the erection of any building. I have done a good deal of drafting in connection with my building, and have drawn a number of plans complete which passed with praise, but as I never received any instruction in architecture except such as I learned from different works on drafting and architecture, I know, of course, that I am crude and uninformed on many points, and my wish is to find a school or place of instruction where I can correct these.

I am aware there are many schools where architecture is taught, but all I am informed of require a three to five years' course, and do not meet my wishes.

Any information you can give me on the subject will be thankfully received. Yours truly, WM. MCCABE.

[THE course for our correspondent to follow is to spend a year or two in the architectural department of the Massachusetts Institute of Technology, Boston, where they admit special students, and where it is possible, within reasonable limits, for a student to follow his own bent and devote himself mainly to the study of those branches in which his previous education has left him deficient. With the aid of capable instructors, the freedom of a good library and collections, and the influence of the architectural character of Boston buildings, a builder, such as we take our correspondent to be, should be able to transform himself into an architect more speedily than by any other course we can devise. — EDS. AMERICAN ARCHITECT.]

A PROBLEM IN SLOW-BURNING CONSTRUCTION.

TORONTO, January 7, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — How would you adapt the system of slow-burning construction to a college building under the following conditions:

1. Rooms to be of sizes ranging from 19′ x 30′ to 36′ x 39′.

2. No columns to be used and, as far as possible, ceilings to be unobstructed by beams.

If these conditions are impracticable, what would be the least amount of obstruction by columns and otherwise required.

ENQUIRER

[USE beams heavy enough to carry safely the floor and the required load, spacing the beams not less than five feet apart, and more, if possible, up to nine or ten feet. Cover with three or four inch splined planks, according to the distance between the beams, with seven-eighths inch or one and one-fourth inch flooring over, and plaster the ceiling below on wire lath, carrying the wire around the beams and close to the underside of planks, leaving only space enough between the wire and the wood for the clinch of the mortar. Just where the beams should be placed, and what should be their size and spacing, it would be impossible to say without knowing all the details of the plan, the position of doors and windows, and so on. To cover rooms of the size mentioned on the slow-burning principle without

[1] "*The Theory and Practice of Surveying*," Designed for the Use of Surveyors and Engineers Generally, but especially for the Use of Students in Engineering. By J. B. Johnson, C. E. Professor of Civil Engineering in Washington University, St. Louis, Mo. New York: John Wiley & Sons, 15 Astor Place, 1886.

showing the beams in the room would be impracticable unless by furring in some way so as to get a level ceiling on wire lath below the level of underside of main timbers, and this detracts somewhat from the fire-resisting quality of the construction. With nothing more than the actual weights usual in such structures to provide for, we see no reason why the floors could not be carried without columns, though the large rooms would require very heavy timbers. It should be observed that sound passes much more readily through floors of this kind than through those of the ordinary construction, and if this should be an objection it might be well to adopt some less efficient, but still tolerably reliable precaution against fire, such, for instance, as laying the floors with beams of the ordinary kind, and spaced as usual, but plastering underneath on wire instead of laths, and, in addition, deafening with mortar on top of the under flooring. With brick partition-walls, through which fire could not ascend, this would be a good and not very expensive construction. — Eds. American Architect.]

NOTES AND CLIPPINGS

Artesian-wells for London.— The City Commissioners of Sewers, at their meeting yesterday forwarded by one step a controversy which has been long pending. They carried a motion requesting the Finance and Improvement Committee to "report forthwith" on the power of the commission to sink artesian wells in the city, with a view to being independent of the water companies. In the course of a rather desultory discussion one speaker broadly hinted that the desired independence might be an expensive luxury. When there was a question of supplying a block of artisans' dwellings with water it was found that the cost of sinking the well would be £2,000, and that its maintenance would amount to £180 a year more, as against £60 a year, which was the water-rate for the buildings. This, however, does not dispose of the whole question. Supposing the artesian-well to tap a stratum of pure water, the supply would, beyond question, amply suffice for more than one block of buildings, and that, too, on a far more liberal scale than that of the measured and grudging doles afforded by the companies. That there is a plentiful store of water under London far beyond the reach of sewage contamination is almost certain, and it is a pity that it should not be in some way utilized by a city which needs so much more cleaning than it gets. It is possible that in boring for ordinary water the commission might come upon a chalybeate or saline spring which would supply London with a home-produced Apollinaris or Hunyadi water. The Beulah Spa on one side, and Bagnigge and other "wells" on the other, are not far off, while only six years ago, from a deep well sunk in Bunhill Fields, was drawn a liquid said to resemble the famous Carlsbad water — so very wholesome and so excessively nasty. Probably, however, the commission would be well content with such water as could, within the memory of men now living, be had from at least a dozen well-known pumps within half a mile of St. Paul's. Those particular sources have long ago been rightly condemned, but it is a paradox to maintain that water brought to us after painful filtrations and long journeys through miles of piping, can be both cheaper and better than that which is filtered naturally through the lower strata, and is ready, when tapped, to rise to the surface at our own doors.— *London Standard.*

The Channel Tunnel.— The shareholders of the Submarine Continental Railway Company held their ordinary general meeting on the 16th inst., at the office of the southeastern terminus, London Bridge. Sir Edward Watkin, Bart. M.P., presided, and, in moving the adoption of the report, said that the Board had carried out the proposals of the shareholders under which they agreed to absorb the property, effects, rights and privileges of the Channel Tunnel Company on the terms which the proprietors had approved. He could not help saying that the progress of the Channel Company was a record of engineering mistakes. First of all it was proposed to construct the tunnel between Calais and St. Margaret's, but that having proved to be an egregious engineering mistake, they shifted their ground on this side to a place called Fair Hole. The directors, however, instructed their engineer to make a boring at the place where it was proposed to bring the tunnel on this side of the Channel, and they found that they were draining the land springs on the Dover side of the Channel. They had, therefore, come back to this position. They had proved beyond the shadow of a doubt that the only way to make a tunnel between the coast of France and the coast of England was by finding the grey chalk, as they had done, and following it to the other side of the Channel. He was happy to tell them that the stratum through which they were going was grey chalk, and their tunnel of 2,200 odd yards was practically dry. There was another fact of equal importance, and that was that the chalk walls and roofs of the tunnel showed no signs of decay. On the contrary, the surface of the grey chalk grew harder as time went on. When it was an unproved condition of things that the tunnel could be bored between France and England a large number of persons were for it, but the moment they proved that it could be done easily and cheaply some persons began to see great international dangers. They received a letter yesterday from the Board of Trade asking to inspect the tunnel. The Board stated that they thought it essential that Lord Stanley of Preston should go and see the Channel works himself. They believed that because Mr. Chamberlain, the late president of the Board of Trade, did not see the tunnel with his own eyes, he had arrested its progress. After quoting from a letter of Lord Derby addressed to Lord Beaconsfield, in which the former stated that the Government ought to support the tunnel, Sir Edward concluded by stating that the time would come when prejudice would blow away like the fogs of morning, and when those who had promoted civilization and peace would get their own reward, not only in the pecuniary way, but in the belief that in constructing the tunnel they had done their duty. Mr. G. Cavendish Bentinck, M.P., seconded the motion, which was carried. The meeting was subsequently declared special, when a resolution was agreed to approving the bill empowering the company to continue experimental works for a tunnel beneath the Straits of Dover, and for other purposes.— *The Architect.*

TRADE SURVEYS

The general course of prices is still upwards. In several industries this upward tendency has received a slight check by the extraordinary advance in quotations for crude material and finished products which have been perhaps unwisely made. The intelligent and conservative public opinion of the country is decidedly against any sudden advance or fluctuations in material. A sort of commercial and industrial instinct has been growing throughout the country, for a year or two past, against these changes, and the country at large has been endeavoring to so regulate its production and distribution as to avoid the hazardous changes which, in its past, have upset all business calculations. Every industry shows some evidence of the unsettling influences at work, some a great deal more than others. Investors who contemplate extensive operations of one kind or another during the coming season have been somewhat alarmed at the fluctuations of the past thirty days. Just as soon as they were satisfied that the labor question was likely to be passed over without serious agitations another factor arose, namely, the possibility of an unwise advance in prices. Thus far the building trades have not been affected. It is useless at this time to pretend to anticipate the effect of causes at work. Just now the indications point to a further advance of prices all around. The fact that from three to six months' supplies have been contracted for at low prices will act as a cushion to the damaging results that the recent advance may involve. Prices are very firm in all markets. Iron and steel are taking the lead. An advance of from three to five dollars per ton has been made within a month in steel rails, but fortunately rails enough to lay as much as 12,000 miles of road have already been contracted for at $34 to $35. The advance from $37 to $40 does not, therefore, mean very serious results to the railroad builders. Those who will suffer are those who are able to suffer, namely, the well-fixed railroad companies, including the trunk lines and the host of well-established railroad companies over the West and South. These buyers will, no doubt, be obliged to pay at least three to four dollars per ton more for what rails they will want. The unsold capacity has been estimated by some authorities at 600,000 tons, and if this product sells at the advance of $4 per ton over last autumn's price it will make a difference to the companies of some $2,500,000. This advance, if it does retard railroad-building enterprise, will be beneficial rather than otherwise, as there is a tendency to rush too rapidly into railroad construction. The published records of railroad bankruptcy show that considerable mileage is still unprofitable, but the present investors and projectors of roads are basing their calculations not upon the past and its unprofitable realizations, but upon the future and its promising increase of traffic and dividends. There is certainly much encouragement to be met with, enough at least to attract millions of idle capital into new railway enterprises all over the country. The iron and steel industries are in a phenomenally prosperous condition. Pig-iron production has now reached about 128,000 tons per week, and furnaces are being built and projected. The pipe-makers have hundreds of miles of pipe under contract. The brokers for old material are unable to meet half of the demands presented. Brokers representing foreign steel and iron makers have been checked in their negotiations for their American customers by the sudden advance of prices in foreign markets. Cablegrams show a general improvement in iron and steel throughout Great Britain and Europe. The host of new enterprises are the result of the great activity of the past two or three months on our side, and the projection of these enterprises is the basis of the advance now being attempted. It is possible that these enterprises may be alarmed and checked, but the chances are that they will plunge ahead and accept all the risks involved. The coal-mining industry also shows as favorable results as others. The makers of machinery have all begun to book orders for heavy machinery for spring and summer delivery to manufacturers of all kinds and in all parts of the country. Whatever the wisdom of it may be the fact is that we will witness this year a very heavy increase in our machinery capacity. The increase will not be confined to four or five lines, but to all lines of manufacturing. Boston shows a fair increase in building activity in 1886 over 1885; New York has expended some $13,000,000, if the estimates are correct; Philadelphia has exceeded its 1885 record by some $7,000,000 if guess-work will answer and Chicago's figures show an increase from $19,000,000 to $27,000,000. The figures of St. Louis show a great increase as also do St. Paul, Minneapolis, Kansas City, and several of the larger cities in the South. The best posted architects throughout the West incline to rather bullish views in regard to building construction as well as to railroad construction. In fact, they base their predictions, or rather their opinions, as to the building activity of 1887 on the railroad construction which they know will take place. It is simply a logical calculation over admitted premises. So far as can be ascertained there is no reason for expecting any less increase in 1887 over the increase of 1886 than 1886 has shown over 1885. The boom, if it is one, will expand until it explodes, but for reasons frequently heretofore enumerated it is fair to say that the activity now enjoyed is not a boom, but is a legitimate growth from causes which have been silently working for many years. The low rate of interest on money, the strengthening confidence in new enterprises, the growing interests of the people, the increasing profitableness of agricultural operations, mining and lumbering operations all go to strengthen the demand for all kinds of staple products, and this improving demand is the best for the building activity which is not yet showing any signs of exhaustion. In whatever industry the endeavor to probe for indications of weakness is made, we find nothing to warrant unfavorable conclusions. It is very true that manufacturers and jobbers and retailers, and all who make and handle products of any kind, are complaining of low prices, lower than they ought to be. But, on the other hand, the margins, as compared with those of a year ago, certainly show that an improvement has taken place. The year opens with bright prospects for real estate not only in all our large cities, but in all of the smaller cities and towns from which reports have been received. The most favorable feature is that the improvement made is legitimate and not speculative, and it is evident that holders of real estate are more anxious to see property improve than to hold property in check for farther advance excepting where, as is frequently the case, valuable sites are held back by testamentary conditions. The improvements in real estate may possibly take a sudden start, but it so happens that the building interests in most of our cities have taken time by the forelock and have purchased much property for future operations. This is a notable truth in New York, Philadelphia, Chicago and St. Louis. In addition to this activity a great deal of suburban property and of farming lands have been purchased near large cities. This is due partially to the fact that suburban properties are to be had at low prices, and partly to the fact that investments are desirable and farming lands near larger cities are selected as the most desirable form of investments out of stocks and bonds by a large number of producers.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. NO. 578.

JANUARY 22, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

A LITTLE book has recently been published by the American Economic Association on "*Coöperation in a Western City*," by Mr. Albert Shaw, one of the editors of the Minneapolis *Tribune*, which gives an account of a remarkable and most important industrial movement, which has been quietly going on in the pleasant twin city of the Northwest. Every one knows that Minneapolis manufactures more flour than any other city in the world, and consumes in consequence an enormous number of barrels, several million being used every year. The production of barrels is therefore a flourishing industry in the city, employing between seven hundred and eight hundred men, more than half of whom now work in associations on the coöperative plan, furnishing their own capital, making their own contracts for their goods, taking their own business risks, and dividing profits instead of receiving weekly or fortnightly wages. These associations have come into existence very quietly, have been managed in a sensible and undemonstrative way, and have been, as a rule, very profitable. So far, they have attracted neither attention nor interference from labor-reformers or enthusiasts of any kind, and it is doubtful whether the efforts of either of these would now be able to break them up, and drive their members back to a life of monotonous dependence.

BY the side of these remarkable associations, but in the sister city of St. Paul, have grown up a group of building associations unrivalled perhaps, by those of any community in this country, and possibly in the world. There is perhaps no writer on social science in any country who has not extolled the English building associations, with their admirable system of investing and lending money so as to promote the building of small dwellings. In Philadelphia, where the habits of the people favor them greatly, such associations are now very popular, and in Boston, mainly through the efforts of a single energetic gentleman, Mr. Paine, they are beginning to find favor, but in St. Paul, without special advocacy on the part of any one, they have attained a great extension, and it is said that one-fourth of all the families in the city are represented in them. At present there are forty associations of the kind there, most of them large ones, to judge from the account, which says that their receipts amount to eighty thousand dollars a month, or nearly a million a year. This income, which, although far surpassed by that of the great London associations, is astonishingly great for a town like St. Paul, in which building associations date back only about ten years, is annually invested in more than a thousand loans, mostly on small dwellings, and it is asserted that between eight and ten thousand houses, in St. Paul alone, have been built for their owners, mostly men of small means, by the aid of these loans.

DR. O. W. WIGHT, the energetic and clever health officer of Detroit, has designed and constructed a pest-house, or rather a hospital for contagious diseases, in the suburbs of that city, which is described in the *Sanitary News*, and well deserves the attention of architects. The plan of the structure, which consists of a cellular mass of fifteen rooms, eight being octagonal, connected by seven small square ones, although very economical, is open to the objection that the three inner rooms, one of which contains the bath-rooms and water-closets, while the two adjoining ones are devoted to convalescents, are rather badly situated for light and air, the only windows which they possess being twenty feet above the floor, opening over the roofs of the exterior rooms; while the convalescent rooms, which form the only passage-way between the baths and closets, and all the other rooms in the building, must be anything but pleasant places for weak and nervous persons to stay in; but the system of construction is admirable. Proceeding on the principle that everything like neglected hollow spaces or absorbent materials was to be avoided, Dr. Wight conceived the idea of building his hospital by the well-known method in use for constructing grain elevators. Seasoned pine planks, two inches thick and four inches wide, are laid flat, one above another, and spiked together, to form all the walls and partitions. The outside is covered with vertical boarding, nailed directly to the planks; but all interior surfaces are simply planed smooth and varnished. The walls thus formed are cheap, dry, non-absorbent, and to a considerable degree fire-resisting, and have the great advantage of being readily washed by a stream from a hose, without having the damp quality, and the propensity to condense a foul, clammy moisture on their surface, which belongs to walls of masonry covered with tiling or impervious cements. The windows are large, and divided into three sashes, of which the middle one is stationary, and the sashes are double-glazed. All the rooms are open to the roof, which forms a congeries of pyramids, each having the room under it for a base. The roofs are formed of plank, two and one-half inches thick, covered with tin. The floors are double, the under floor being of pine, with an upper floor of maple. The rooms are heated by low-pressure steam, on the direct-indirect plan. The whole cost of this ingenious and serviceable structure, which will easily accommodate fifty patients, was only eleven thousand dollars.

MR. JAMES WEBB, one of the oldest and best-known building contractors in New York, died last week in his eighty-seventh year. Mr. Webb was for many years employed by the great New York families of the Astors and Van Courtlandts, and remembered perhaps more of the city in the early part of the present century than any New Yorker of the present day. His first contract, after he had finished his apprenticeship as a mason, was for a house for one of the Van Courtlandts, who then owned and kept negro slaves. This house was in Morris Street, not far from Trinity Church, which was then a fashionable locality. Soon after this, he was called upon to build a "country house" for the mayor of the city, Philip Hone, at the corner of Beekman and Gold Streets. This house, though now buried in the heart of the busiest part of New York, still stands, and bears the initials of the mayor's name on the gable. Mr. Hone's office was in Whitehall Street, so that he had a walk of a mile and a half, or thereabouts, to his new suburban residence. It was about this time, we believe, that the New York Hospital was built on Broadway, below Worth Street. Although the location of the hospital was five miles below the present fashionable quarter, it was considered sixty years ago so far out in the country that the hospital physician, who lived in the city, which then extended little north of Wall Street, was granted the use of a horse and carriage, at the expense of the hospital funds, to take him to and from his work. After "Greenwich Village" had been pretty well built up, and the Bowery, on the other side of the town, had lost its suburban character, a bold step was taken in crossing the Canal, which was then a creek, connecting the two rivers, and spanned by a bridge at Broadway; and building recommenced on the higher ground on the opposite shore. The two Astor brothers, William and John Jacob, built, by the hands of Mr. Webb, comfortable up-town residences on Broadway and Lafayette Place, and fashion followed them to Lafayette Place, Astor Place, Clinton Place and Washington Square. In their turn, these streets have been given up to business, and the tide has

moved forward until the houses which Mr. William B. Astor's sons built, with pretty gardens attached to them, on Fifth Avenue and Thirty-third and Thirty-fourth Streets, about a mile and a half beyond the home of their childhood, are now nearly surrounded by plate-glass shop-windows and gilt signs. It seems strange that in one man's life-time a great city should be so completely transformed; yet New York is growing faster now than ever before, and our children will probably listen some day with amazement to our stories of the rocks and shanties which are fast disappearing from the neighborhood of the upper Central Park.

THE most astonishing boiler explosion yet described seems to be one which occurred last month in Pennsylvania, where a locomotive, with four men upon it, blew up, just after it had been thoroughly repaired. According to the *Scientific American*, this engine, which was of the heaviest "consolidated" type, was built at Schenectady three years ago, and ought, therefore, to have been just about in the prime of its life. The tubes had begun to burn out, and the engine was sent to the repair-shop, where one hundred and twenty, out of the two hundred and twenty tubes which the boiler contained, were replaced by new ones, and a large number of bolts and rivets were renewed. The boiler was then tested by hydraulic pressure, but only to one hundred and fifty pounds, the intended maximum working pressure being one hundred and twenty-five pounds. When the work was done, steam was raised for a trial trip, and the engine was moved out of the shop and upon a side track, and the engineer was ordered to run up and down the track a few times, to see that everything worked smoothly, and meanwhile to set the safety-valve at one hundred and twenty-five pounds. The steam-blower was turned on, to raise the pressure to the required limit, and the machinist climbed to the top of the cab, where he sat, screwing down the safety-valve, and waiting until the engineer should give him the signal that the steam-gauge showed the pressure desired. Some of the bystanders noticed that the blower was kept in operation an unusually long time, and a man on a train which happened to pass remarked that the sound of the blower showed that there was a high pressure on, but the gauge seems not to have registered the specified maximum, and nothing unusual was observed until a pipe which had been repaired, gave way, and the next instant the boiler was torn into two pieces; the front and upper portion, with the machinist who was at work on the safety-valve, and two other men who were standing on the engine, being hurled into the air, at an angle of about thirty-five degrees with a vertical, so far that it looked like a speck in the sky. Later, this part, with the bodies of the three men near it, was found a quarter of a mile away, on the other side of the crest of a hill four hundred feet high. The body of the engineer, who was in the cab, was found by itself, half a mile from the others; but of the rear portion of the boiler no portion has yet been discovered. The tubes were scattered in all directions, one having been driven entirely through a neighboring house, and some fragments have been picked up a mile from the scene of the explosion. The only explanation of the accident which has been given is that the cock in the pipe connecting the steam-gauge with the boiler had been in some way nearly closed, so that the gauge only registered a fraction of the real pressure in the boiler.

THE *Builder* gives an account of some novel applications of cement concrete, which have recently been made by Mr. David Wilson. The most curious of these is perhaps to be found in the use of the concrete for making telegraph-poles, which are now regularly made for the markets, and are found strong, durable, and very little heavier than wooden ones. These concrete poles are made, it is hardly necessary to say, upon a skeleton of wire netting, which is set up in a cylindrical mould, having a core set inside. The concrete is then poured in at the top of the cylinder, and allowed to harden; and if the materials are good the poles are very serviceable. Wooden blocks embedded in the concrete serve for attaching the arms. The same principle is applied to the formation of sewer-pipes, which are easily made of nine feet in diameter, and, when formed over two cylinders of wire netting, are very strong, durable and cheap. Cylindrical sections made in the same way, with a bottom added, are found to answer admirably for water-tanks, needing no painting, and being free from any liability to rust or decay. The American, Mr. Thaddeus Hyatt, was, we believe, the first to point out that the coefficient of expansion by heat was nearly the same for Portland cement as for iron; and to experiment on combinations of cement-concrete and iron, by which the metal was employed to resist the tensile strains, leaving the concrete to sustain only compression; but, beyond the publication of a very interesting book on the subject, nothing seems to have resulted from his experiments. In practice, perhaps some further study is needed to devise means for enabling concrete so combined with iron to resist shearing strains, as well as those of tension and compression, before it will be available for sustaining severe transverse strains; but this advance ought not to be very difficult. To illustrate, by an example, the direction which experiment might, perhaps, take with advantage, we may suppose a floor, intended for carrying heavy loads over a wide span, to be made on Mr. Hyatt's proposed system, by casting it, on a platform erected for the purpose, in a single piece of Portland cement concrete, having a row of iron rods embedded in it, near the bottom, each rod being armed with a washer, or cross-bar, to prevent it from being dragged through the mass by the tension due to a bending strain. On M. Hyatt's theory, if the number of bars were properly proportioned to the concrete, the tensile strength of the part of the mass below the plane of the neutral axis might be made nearly equal to the resistance to crushing of the part above the neutral plane, thus giving an immense resistance to bending; but the resistance to shearing, although this has, we believe, never been determined for concrete, would, as concrete is usually made, be small, and the floor would fail, by breaking through near the supports, long before it could bend enough to try the tension-rods seriously. It would, however, be perfectly practicable to increase the resistance to shearing of the concrete in a great degree, by a suitable choice and disposition of the aggregate. If this, for example, instead of an incoherent jumble of little angular fragments, were to be made of sheets of slate, bedded one above another in the cement matrix, with joints carefully broken, its strength in this particular would be enormously increased, and rods or wires might well be used to give the mass the tensile strength which would then be the only quality needed to give it the resistance desired. Even without the iron rods, such a concrete would have an immense transverse strength. We remember reading, long ago, about certain floors which were made in Germany by laying flat tiles on a temporary platform, then spreading a coat of mortar and laying a second course of tiles, breaking joint with the first; and following this with a third and fourth, laid in the same way. On removing the staging, after the mortar had dried, the floor was found strong enough to sustain the traffic of a dwelling-house over wide spans; and with our excellent cements it ought to be possible to improve considerably on this construction. Such a floor would have the great advantages of exerting no thrust on the walls, and of giving a smooth ceiling underneath, while its weight, being divided uniformly all around its perimeter, would be in many cases more easily and more safely borne than that of a brick or terra-cotta floor carried by iron beams.

THE *Weiner Bauindustrie-Zeitung* says something about the framing of valuable drawings or engravings which is well worth knowing. According to this it is very injudicious to frame such things, as is usually done, by dropping the glass into the rebate in the frame, laying the drawing upon it, pressing this close against the glass by a board, and then pasting a sheet of brown paper over the back of the whole affair, to keep the dust out. With etchings or engravings the oil of the ink gradually exudes from the lines upon the glass, and is carried by capillary attraction over the surrounding paper; while changes of temperature, or the bringing of the picture from a cold to a warm room, condense moisture upon the inner as well as the outer surface of the glass, dampening the paper in contact with it, and either staining it or preparing it for the germination of the spores of moth or mould, which easily get behind the glass through the rebate, in which it fits loosely. To avoid these sources of deterioration, the glass of the frame in which valuable drawings are to be placed should be first prepared by pasting thick paper around the edges, so that when set in the rebate it will fit so tightly that no particle of dust can get through. The drawing should then be pasted by the extreme edges on a mat, stretching it very lightly, so that it will be held slightly away from the glass, and strips of paper then put in the rebate, between the mat and the glass, and around the edges, so that no dust can get in from the back; and, last of all, a sheet of well-sized paper is to be pasted over the back of the frame.

THE WATER-SUPPLY OF BUILDINGS.—I.

EQUALLY important with a thorough system of drainage is an abundant and uniform water-supply. Each is dependent upon and necessitated by the other.

Before water-carriage became general among civilized races as a means of removing household refuse, an efficient system of water-supply was to be considered as simply a matter of convenience. It has now become one of necessity, for without it, thorough flushing is practically unattainable, and plumbing work becomes a source of danger, while with it plumbing may be rendered as safe as any other branch of building, and all its comforts and hygienic advantages may be enjoyed with entire confidence, and in absolute security.

Just as we have already shown to be the case in drainage, however, so in water-supply, there is a tendency at present to undue complication in the work. Here again, money which should be spent on better and stronger work is wasted upon a vast amount of unnecessary material. The house-owner is discouraged at the complexity of piping and superabundance of apparatus to be used, and is "forced to 'cut down'" in the quality as well as in the quantity of his work.

We hope to be able to show in these articles ways in which this unnecessary complication and expense can be avoided.

VARIOUS METHODS OF WATER DISTRIBUTION.

The water-supply may be distributed in a house in three different ways, *i. e.*, either directly to each fixture from public mains, or indirectly from a storage-tank; or through a combination of these two systems. Where a storage-tank is used, it may be fed either by the public main, or by pumping from a well or cistern. The first is employed in cities where public water-works are carried out. The last in thinly-settled country districts and in isolated dwellings, where a public water-supply would involve much greater expense to the individual than private wells and cisterns.

We shall take up first the consideration of

WATER SERVICE IN CITY HOUSES.

The Storage-Tank.—The chief desideratum here is to obtain a constant supply and uniform pressure at each outlet and fixture; the quality of the water furnished by the public service being a matter over which the individual has no control after the water-works have been completed. Inasmuch as the quality of the water provided by the authorities is usually suitable for all ordinary domestic purposes, the construction of auxiliary cisterns for collecting rain or well water is seldom required in cities. Not so with the quantity and uniformity of the supply. From numerous causes the water-pressure must constantly vary. Fluctuations in the rainfall, the source from which the mains are directly or indirectly fed, and in the consumption of water at different seasons of the year and hours of the day; alterations or repairs in the pipe system constantly occurring; all have their effect on the pressure, and render, under the refinements of modern plumbing, a direct reliance upon these main pipes, without the addition of a storage-tank, very unsatisfactory. Where no storage-tank is used, it often happens that no water can be obtained in the upper stories of a house at times, when water is being drawn anywhere below. In the case of lavatories this may be nothing more than a source of inconvenience; but in the case of water-closets it may entail considerable danger, inasmuch as the closets will be left unflushed by careless or forgetful persons, if at the time of using, the flush cannot at once be obtained. Moreover, the danger is further increased by the fact that, when the water-closet valve is opened under such circumstances, foul air may be drawn into the supply-pipes from the water-closet room, to pollute the drinking water.

Another danger of the direct-supply system is the liability to rupture of the pipes under the severe strain brought suddenly upon them, when a faucet is shut off under a heavy pressure of water. This heavy pressure will always tend to wear out the faucets as they are generally made, and make them leak in a short time. The leak involves a repair, and a repair when there is no storage-tank, often involves an entire disuse of the plumbing fixtures until it is completed. Should the work of reparation occupy considerable time, there is danger of the water-closets becoming offensive and nocuous for want of sufficient flushing. Should the repair be required in the public mains outside of the house, the unforeseen shutting-off and subsequent turning-on of the water may occasion the bursting or collapse of the kitchen boiler.

Thus we find that the direct-supply system has many serious disadvantages and dangers, and a storage or distribution tank should, in all cases be used, in city as well as in country houses, without exception. It is generally supposed that the tank system must be more expensive than the direct-supply, but we shall find that this is an error, the reverse being really the case.

We have then, for our first principle of water-supply, that every house should be provided with such a tank. It must be understood, however, that it does not follow from this that all the water used in the house should be drawn from it. The drinking and cooking water, and sometimes the cold water for lavatories should be taken from the pipe which supplies it, rather than from the tank itself, which should be reserved for the supply of water-closets and of hot-water for lavatories.

MATERIAL AND GENERAL ARRANGEMENT OF THE SUPPLY-PIPES.

The material now in general use for direct as well as tank supply is lead. From its cheapness and facility of working, it has long been the favorite material with plumbers, and for tank distribution-pipes, it has no serious objection.

For conveying drinking and cooking water, however, sanitary considerations sometimes preclude the use of unprotected lead when the water is of such a character as to act upon it. The nature of the water in this respect in any locality must be obtained from competent local authorities. Other defects in lead for supply as well as for waste pipes are its softness and great weight which attributes cause it to "sag" and "crawl," after being put in place. It has little toughness and no elasticity, and its use for supply-pipes seems destined very soon to be superseded in a great measure by iron, as it already has been in the main waste-pipe system.

Protecting Lead Pipe.—A protective coating, more or less effectual, may be applied to lead pipes by filling them with a weak solution of phosphate of soda, which precipitates upon their inner surfaces an insoluble coating of phosphate of lead. Or sulphate of potassium or sodium may be used, forming a precipitate of sulphate of lead. These chemicals produce quickly the same effect of protection as would be produced slowly by the natural flow of hard water through the pipes.

Tin-lined Lead Pipes.—Lead pipes may be protected more reliably by lining them with a stout coat of tin, the salts of which, formed by water, are also insoluble and harmless. The interior lining of tin should, however, be thick, and in fact, a continuous and independent pipe forced into permanent contact with the lead by hydraulic pressure. This pipe is considerably more expensive than lead pipe, and requires greater care in putting together than the latter, to avoid injuring the lining.

Tinned brass ferrules or couplings should always be used in jointing. These are furnished by the manufacturers, with the pipe.

A prejudice has arisen against the use of this pipe, on account of the poor quality of much that has been sold. The coating of tin has been too thin, and the jointing improperly done. The result of this is that the lining easily breaks, melts or wears off in places, leaving the lead exposed, and the two metals then produce, in the presence of water, a galvanic action, which is supposed to seriously hasten the destruction of the pipe.

Pure Block-tin Pipes are perfectly safe from a sanitary point of view, but they are difficult to handle and repair. These drawbacks and the great cost are sufficient to limit the use of block-tin to very rare occasions.

Brass and Copper Pipes are easily attacked by water, and the resultant salts are poisonous. Hence, if used for the conveyance of drinking-water, they should be tinned on the inside. Nevertheless, the tin coating, as usually applied, has no appreciable thickness, and will not long protect the brass or copper from corrosion. They are, therefore, not to be recommended for conveying drinking or cooking water in any case. Brass is still very largely used for hot-water lavatory service, in preference to lead, as it is better able to stand the alternations of heat and cold to which this service subjects them. Lead in this case would soon be destroyed by this action.

Wrought-Iron for supply-pipes has, besides its sanitary advantage, that of great strength, toughness, cheapness, and facility of jointing. Although instances have often been cited of unprotected wrought-iron service-pipe lasting for from ten to

twenty years, we know that it requires some permanent coating to render it in all cases safe against destruction and clogging. Water coming through iron pipes is uninjured for drinking, and indeed is sometimes improved.

An enormous amount of time and ingenuity has been spent in the search for a permanent protective coating for iron which should be at once cheap and reliable; but until within the last few years with no very encouraging results. Galvanizing or zinc coating was, when first introduced, thought to have solved the problem, but a great many kinds of water are found to decompose the zinc and yield with it poisonous salts; moreover, imperfections in the coating, difficult to avoid, cause a destruction of the iron much more rapid than would be the case were no coating applied, so that this means of protection is now regarded as altogether unsatisfactory.

Tin-coated iron has never met with success, on account of the difficulty of making the tin adhere to the rough inner surface of the pipe. Tin-lined iron pipe, however, in which an independent continuous pipe of tin is inserted within the iron, the two being brought into close contact by hydraulic pressure, forms, if properly put together, a very good supply-pipe. As with the tin-lined lead pipe, great care should be taken in jointing, and special tin-lined iron fittings furnished by the manufacturers should be used for all joints. This pipe, however, can scarcely be classed as *coated* iron pipe. It is practically nothing more than a double pipe, of tin and iron, of which the outside receives no protection. The pipe is comparatively expensive, and if not very accurately jointed, galvanic action assists natural corrosion and hastens destruction. It has never found great favor among plumbers, and is rarely used.

From glass-lined iron pipe much was expected when it was first introduced, a few years ago; but it is difficult to cut with the ordinary tools used by plumbers, and, largely on this account, it has never become popular. This difficulty, together with its expense and the brittleness of the lining, have been considered so great that its use has for some time been practically abandoned.

Asphalted wrought-iron pipe has been much used, but cannot be considered as a permanent pipe. For hot-water conveyance it is not well suited, on account of the tendency of the hot water to destroy the coating.

Enamelled iron pipe varies as much in character as in the variety of ways in which it is made. When new, the different kinds resemble each other so much that it would be impossible for the ordinary observer to distinguish between the good and the bad. With some the enamelling consists of nothing more than a shiny but perishable coat of baking varnish. With others the pipe is coated with a thick, hard, glossy elastic enamel of great durability.

The Bower-Barff Process.—There is another protective treatment of iron totally different in character from any of the preceding, which appears to have met the problem before us in a most satisfactory manner. No foreign substance whatever is added to the iron, except oxygen, which converts its surface into a magnetic oxide. This coating has the remarkable power of effectually withstanding, apparently indefinitely, the corrosive action of air and water, hot or cold, fresh or salt, under most trying conditions.

The formation of the magnetic oxide is accomplished by subjecting the iron to the action of superheated steam in furnaces especially constructed for the purpose. The cost of treatment is very low, and, so far, the results have answered every expectation, and been eminently satisfactory. The pipe is put together like ordinary gas-piping, with screw-joints, except that only oil need be used at the threads, instead of red or white lead. The oil soon becomes sufficiently hard to make a tight joint, and is free from the danger of poisoning the water.

We believe that this pipe is destined to supplant all others for the conveyance of water. There are many places in plumbing, as we shall show, in which its use would be safe beyond all question, and would effect a great saving in the cost of the work. The writer has for some time been conducting a series of experiments on iron thus coated, the results of which tests will be given farther on.

[To be continued.]

Proposed Restoration of Hereford Cathedral.—It is proposed that the Herefordshire memorial of the Jubilee shall take the form of a complete rebuilding of the west end of Hereford Cathedral, which it is estimated will cost £80,000 if the work be thoroughly carried out. The dean and chapter expended £50,000 in the elaborate restoration of the other parts of the cathedral, which was finished in 1863, after having been in progress for more than twenty years.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — VII.



LIGHT-HOUSE OF HEAUX DE BRÉHAT.

On the coasts of France, light-houses were needed, as in England, on difficult sites, and it is interesting to compare the different manners in which similar problems were solved in the two countries. I have selected the Light-house of Heaux de Bréhat as one comparative type; it is situated about three miles from the most northernly end of the Peninsular of Brittany, on the plateau of Heaux de Bréhat, which consists of a porphyritic rock about five hundred and sixty yards in diameter at low tide, and entirely submerged at high tide except a few scattered projections.

Here the currents are very strong, at times running as high as eight knots an hour, and the sea in gales attaining an extraordinary violence.

The tower instead of being placed on the highest part of the rock, was situated at a place near which landings could most conveniently be made in order to reduce as much as possible the cost and delay of landing the materials used in its construction.

At the Isle of Bréhat near by, a natural harbor was improved; and the storehouses and work-shops were built. All the stones were cut here, and in order to insure accuracy each course was laid out on a platform; the stones were then shipped on barges of about forty tons burden, each stone carrying its number, its sling, and surrounded with straw mats to prevent its edges being chipped. The stones were unloaded, and placed by means of a series of derricks, which passed the stones to each other. A flying scaffold was also used for the convenience of the workmen, and was carried up as the work progressed. It consisted of a series of small fir trestles clasped against the tower by means of two chain bands which were tightened by jack-screws. When the scaffold was to be raised, the men stood on the masonry; the screws were loosened, each man seized a trestle, and at the word of command all lifted together. The chain bands were then retightened; the entire operation did not take more than half an hour.

The accompanying drawing, taken at low tide, shows how the work was carried on when the tower had reached the height of about one hundred and thirty-five feet above the rock. It was important that the men should live on the rock, so that they could be usefully employed, even during bad weather.

No matter how well and carefully the stones might be prepared, they had to be finished on the spot; and notwithstanding that arrangements had been perfected to assure rapidity in the landing of material, it was at times impossible to lay all of the stones of a cargo during one low tide.

Two adjacent slender peaks, near the centre of the plateau with their summits almost twenty feet above the highest tides, offered a good site for the erection of the necessary buildings. The space between them was filled with loose stone retained in place on one side by a vertical wall, and on the other by an inclined plane, both built of heavy blocks of stone laid in cement. A nearly square platform was thus made about thirty feet on the side, on which was erected a stout frame building, well anchored to the rock, and containing storerooms, a small forge, and rooms for the engineer, foremen and workmen. The building was surmounted by a small tower, from which was shown a temporary light. In this building were accommodated sixty men, who worked on the rock as soon as it was uncovered by the falling tide, and who found it their only refuge when the tide again rose.

In the light-houses at Eddystone and Bell rock, the lower courses were bonded together in a complicated manner by means of dovetails, and were held to each other by numerous iron or wooden dowels; at Skerryvore there was a departure from this system, which in addition to the expense it entails, materially retards the work at its critical stage. At the light-house of Bréhat there was a still farther departure from precedent, and it was decided not to fasten each stone separately; but to limit the quantity of masonry to that which could be put in solidly during one low tide.

Each course was divided into a certain number of sections or keys, each of which was connected by means of four small granite blocks;

[1] Continued from No. 576, page 16.

fitted in each course, and placed in the angles of the sections. The angular stones belonging to the exterior facing, being thus kept in place, form tie pieces; supporting the facing stone which come between them, and are attached to those which compose the sides of the key by means of dovetails let in their whole thickness. Finally, the interior face, maintained upon the preceding course by two stones, is also held by the stone belonging to the course above, which being placed across the joint allows the tie pieces on that side to be suppressed. The perimeter thus being made firm, artifices of construction were not required for the interior; and in the lower courses where it was necessary to finish rapidly, and where there was considerable surface, it was completed in rubble masonry. This method was entirely successful; in no case was any damage sustained when an entire course could be finished before the return of the tide, which was generally accomplished; it was the same even when the work had to be discontinued, without having to place any other stones than those of the facing, from which the work was always commenced; occasionally they were not prepared in time, and some stones were raised and moved a short distance out of place. These were readily reset, and the method was found advantageous both as to economy and rapidity of execution.

The porphyritic rock on which the light-house is built is of extreme hardness, and rapidly wears out the best tools; but in many places it is fissured, and the sea breaks off small fragments. This prevented the establishment of the foundation on the same level throughout, and it was found necessary to divide it into several parts so as to avoid any chance of its being swept away, and also to diminish the cost of excavation.

In the centre a circular space fourteen feet in diameter, corresponding to the interior hollow of the tower, was left untouched; outside this an annular space thirty-nine feet in exterior diameter was levelled off six inches below the lowest portion of this part of the plateau; then at the circumference there was hollowed out a trench forty inches wide, of a depth varying with the condition of the rock so that no part of the base should be protected by less than sixteen inches in height of compact porphyry.

The light-house consists of a tower with an interior cylindrical opening fourteen feet in diameter, and one hundred and fifty-eight feet high from its base to the lantern floor. It consists of two principal parts, the lower trumpet-shaped and solid to three feet four inches above the highest tides, the upper, considered as standing on an immovable base has a degree of lightness about the same as that usually given to towers of the same height built on shore; the thickness of the walls is four feet four inches at the bottom and decreases to two feet ten inches at the top under the cornice.

The interior is divided as follows: the two lower stories are store-rooms, the four above are the kitchen and keeper's quarters; the seventh, fitted up rather better than the rest is a room for the engineer; the eighth is a watch-room, and above that is the lantern-room.

The casing of the stairway is built in the tower wall on one side, and forms on the other upon the cylindrical opening of the tower, a projection, the recesses on each side of which are utilized as closets. The entire work is built of granite of fine, close grain, and of a bluish tint. The arches are built of brick, made according to pattern, except the one supporting the floor of the service-chamber which is of concrete, the brick not arriving in time.

The cost of this structure was $106,365 exclusive of the lantern and illuminating apparatus.

LIGHT-HOUSE OF AR-MEN.

More difficult than the preceding was the building of the foundation of the light-house of Ar-men, France. The island of Sein is situated on the western extremity of the department of Finisterre, in the northwest part of France, and extends in a westerly direction by a succession of reefs to a distance of nearly eight miles from the island. The tops of some are elevated above the highest tides; others are alternately above and below the surface of the water, while the greater number are always submerged. They constitute a sort of dam, whose direction is nearly perpendicular to that of the tidal currents, and the sea constantly breaks over them with great violence.

In April, 1860, the Light-house Board of France determined that the subject should be thoroughly investigated, in order to know if it would be possible to erect a first-order light-house on one of the rocks not covered by the sea and as near as possible to the end of the reef. Next June this action was approved, and a commission of engineers and officers of the navy were charged with the duty of making surveys of the locality.

In July this Commission had made a careful examination of the local conditions, and ascertained that there were three rocks at the extremity which projected above the water, even in strong tides. Of these rocks, which are called Madion, Schomeor and Ar-men, the two first are nearly covered, while the third rises to about five feet above the lowest ebb-tides.

The state of the sea had not permitted the Commission to land, or even to go alongside Ar-men, but from the view that could be obtained its dimensions appeared insufficient for the construction of a great light-house, and landings seemed impossible, even in the most favorable weather.

The Commission, therefore, unanimously recommended the selection of the Rock Neuerlach as a site, about five miles inward from the end of the reef. This recommendation was not approved by the Board, as it did not tend to ameliorate the existing state of things sufficiently for the needs of navigation, and the Ministry of Marine was requested to order a thorough hydrographic survey of the end ofthe reef.

Various circumstances retarded the execution of this work. In 1866, M. Ploix, engineer and hydrographer, was sent to the spot, and though he was not able to gather all the necessary information, still, his investigation was sufficient to enable the Board to decide upon a plan — his conclusion was that Ar-men was the proper site. In true French style he said, "It is a work exceedingly difficult, almost impossible, but considering the paramount importance of lighting the reef, we must try the impossible."

The currents passing over the reef are most violent; in high tides their speed exceeds eight knots, and in the calmest weather they cause a strong chopping sea as soon as a breeze meets them. It is only possible to go alongside the rock during very gentle winds between the north and east.

The impossibility of anchoring a floating light was recognized as much on account of the great depth of water as of the fact that the bottom was thickly studded with rocks, about which the anchor-chain would be fouled.

Owing to the great difficulty of construction the project of establishing an iron structure resting directly on the reef was not entertained, the Board finally deciding that a solid masonry foundation must be established of such dimensions as would be suitable for the construction of a light-house.

The size of the rock, which was of tolerably hard gneiss, was about twenty-five by forty-five feet at low tide; the surface was very unequal and divided by deep fissures, and, while almost perpendicular on the eastern side, there was a gradual slope on the western.

The following mode of construction was decided upon: To bore holes a foot deep, and three feet four inches apart, all over the site of the intended structure, with other holes outside this limit, for ring-bolts necessary to hold boats coming alongside. The first set of holes was to receive wrought-iron gudgeons, to fix the masonry to the rock and to make the construction itself serve to bind together the various parts and the fissures, and thus consolidate a base whose precarious nature gave rise to some misgivings. Other additional gudgeons were to be used as became necessary, and strong iron chains were to be introduced into the masonry as it progressed, so as to prevent any possible disjunction.

For the work of boring the holes the services of the fishermen of the Seine were called into requisition, as they were familiar with all the rocks of the reef, and were in a position to take advantage of every favorable moment. After many difficulties, they accepted a contract, the Government agreeing to furnish tools and life-belts.

In 1867 work was vigorously begun and every possible chance was seized. Two men from each boat landed on the rock, and, provided with their life-belts, lay down upon it. Holding on with one hand, they held the jumper or the hammer in the other, working with feverish activity, the waves constantly breaking over them.

One was carried off the rock, and the violence of the current bore him a long distance from the reef, against which he would have been dashed to pieces, but his life-belt kept him afloat and a boat went to fetch him back to work. There is no record as to whether he was docked for lost time.

During the building of Minot's Ledge light-house, near Boston, a similar accident happened, and though the man was saved he lost his tools. To prevent a recurrence of this disaster, he fastened the tools to his wrists with long cords. Another heavy wave washed him off, and he floated away as before, with the exception that this time his feet instead of his head appeared above water; however, he was rescued in time, but not in a condition to do any further work that day. It is unnecessary to add that he tied himself to his tools no more.

At the close of the season's work at Ar-men, seven landings had been made and eight hours' work accomplished, during which time fifteen holes had been bored in the higher parts of the rock.

The following year more difficulties were encountered, as it was necessary to commence on the part hardly above water; but the experience gained was valuable, and the fishermen were stimulated by higher wages. The season proved favorable. Sixteen landings were effected, giving eighteen hours of work, during which forty new holes were bored, and they even succeeded in partially levelling and preparing the rock for the first course of masonry.

The actual building of the masonry was not commenced until 1869. The galvanized wrought-iron gudgeons, forty inches long and two and four-tenths inches square, were fixed in the holes, and the masonry of small undressed stone was laid in Parker-Medina cement. A cement of the most rapidly hardening character was essential, for the work was carried on in the midst of waves breaking over the rock, and which sometimes wrenched from the hand of the workman the stone he was about to set. An experienced sailor, holding on to one of the iron stanchions, was always on the watch to give warning of such waves as were likely to sweep the rock, when the men would hold on, head to the sea, while the water washed over them. On the other hand, when he announced a probable calm, the work went on with great rapidity.

All the workmen were supplied with life-belts, as the fishermen had been, as well as with spike-soled shoes to prevent slipping. The foreman, also, and the engineer, who by their presence always encouraged the men, were similarly furnished.

When a landing was practicable, the stone and small bags of cement were landed by hand, and care was taken to dress the surface of

the masonry before commencing a new course. The cement was used pure, and of necessity mixed with sea water. Since 1871, Portland cement was substituted for Parker, the resistance of the former to the action of the water having been found superior to the latter, and the stonework at the foot of the tower was preserved by refilling the interstices with this material.

As the tower grew in height, the work naturally proceeded more rapidly, but it was not until 1881 that the structure was finally completed, and the light shown.

The light is of the first order, fixed white, with its focal plane ninety-six feet above the level of the sea. This limit might have been exceeded so as to make it of the usual height of a first-order tower, had it not been for the insufficiency of the base. The stability of the structure was necessarily of paramount importance. There are eight stories, one of which contains the fog signal. The various dimensions are shown in the drawing. It will be noticed that a similar arrangement of the staircase is used here as in the light-house of Heaux de Bréhat.

The work was conceived and planned by M. Léonce Reynaud, director of the light-house service. It was carried on under the greatest of difficulties, and too much praise cannot be given to the brave sailors and Breton workmen who insured the success of an enterprise bolder and more rash than any preceding undertaking of a similar nature.

LIGHT-HOUSE AT HAUT BANC DU NORD.

Another method for constructing a foundation under water was successfully practised during the building of the light-house at Haut Banc du Nord. This is a limestone plateau about two miles off the northeastern extremity of the Isle of Ré. It is nearly horizontal and about fifteen hundred feet long by five hundred broad. It is cut up by numerous channels of various depths, and is only uncovered at low spring tides, when the wind happens at the same time to be off shore. The rocky shoals surrounding it permit only crafts of small tonnage to approach, and at low tide the winding channels render this approach difficult even for the smallest boats. It was therefore necessary to anchor the transports at some distance from the rock, and to convey the material to it in barges — a difficult and risky business, even in a moderately rough sea.

To establish the foundation there was first constructed a large iron bottomless caisson, in the form of a twelve-sided prism, which was suitably braced on the inside. "It was nearly forty-seven feet in diameter, four feet high, and weighed about five tons. Sustained by means of floats, it was towed into place at high tide by a small steamer and then grounded on the rock. After the tide had fallen sufficiently, and while it was not too rough, a movable flooring was placed on the upper frame of the interior bracing, and on it the workmen made the concrete for filling the caisson.

The lower part of the foundation was made of concrete poured through copper tubes one foot in diameter, and funnel-shaped at top. As soon as the water had fallen sufficiently to uncover the concrete, the remainder of the foundation was built of rubble masonry, which could be laid much more rapidly. The solid masonry then built was protected by a band of cut stone, which was placed after the tower was completed.

This work was commenced in 1849 and completed in 1853. The cut-stone protection, however, was not placed until some years later. Its cost was about $66,000.

It is a third-order light-house. The base is a solid mass of masonry. Above are the rooms communicating with each other and with the lantern by means of a series of small stairs. The size of the tower did not admit of a separate staircase, as in the preceding instances.

As reference has been made in the preceding pages to lights of various orders, it is proper to state, for the benefit of the lay reader, that light-houses are divided into various orders, from the first to the sixth, according to the lens apparatus for which they are designed; the first order being the most powerful and also necessitating the highest towers, so that the curvature of the earth will not cut off the light too soon; these are placed on outlying capes, rocks and headlands, to give warning of approach to the coast line. The range assigned to first-order lights varies from eighteen to twenty-seven nautical miles, according to their character.

Second and third order lights are employed to mark the secondary capes, islands, rocks, reefs and sand-bars embraced between the more prominent headlands, while lights of inferior order designate the entrances to harbors and channels, and vary in intensity according to the distance at which they should be seen. These are general principles, but geographical reasons prevent them from being applied rigorously.

[To be continued.]

Adamite Fashions according to the Glass-stainers. — A plain Puritan of Boston, who has been travelling in frivolous Europe, has this to say about a solemn subject: "I was amused with some very old stained-glass windows which admit a 'dim, religious light,' at the Milan Cathedral, and are supposed to illustrate scenes in the Old Testament. It may not have been reverential, but I had to laugh to see Cain in a pair of green pantaloons, killing Abel, who was dressed in a short jacket of yellow stuff. I regretted to see that Eve, when driven out of Eden by the archangel with the flaming sword, was so frivolous as to array herself for the occasion in a purple overskirt, cut very decollette, while Adam wore a blue hat and pink ribbons. There may be authority for these representations — I do not know — but they were a surprise to me." — *Exchange.*

The Illustrations

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE ROTCH TRAVELLING-SCHOLARSHIP DRAWINGS. — PLATES XXXVII, XXXVIII, XXXIX.

[Issued only with the Imperial edition.]

SECOND PERMIATED DESIGN FOR THE CATHOLIC UNIVERSITY BUILDING, WASHINGTON, D. C. MR. O. VON NERTA, ARCHITECT, WASHINGTON, D. C.

The instructions required a plain, substantial brick building with stone trimmings, of sufficient size to accommodate eighty students, eight professors and rector, with all necessary adjuncts as lecture-halls, refectory, chapel, etc. The cost was limited to $175,000. Perspectives were excluded. The building site is a beautiful tract of land of forty acres about two miles outside the city and opposite the Soldiers' Home.

LIGHT-HOUSES AT AR-MEN AND HEAUX DE BRÉHAT, FRANCE.

For description see article on "Ancient and Modern Light-houses" elsewhere in this issue.

OFFICES OF THE MUTUAL LIFE INSURANCE COMPANY OF NEW YORK. MR. C. W. CLINTON, ARCHITECT, NEW YORK, N. Y.

CAPE COD SKETCHES. — NO. II.

THE TREATMENT OF SEWAGE.[1] — X.

I. — AMOUNT OF SLUDGE.



The quantity of sludge varies enormously, according to the amount of sewage and the precipitants employed. Thus, at Coventry the sludge from 1,000,000 gallons is about 12.5 tons, whereas at Birmingham it varies from 25 to 33 tons.

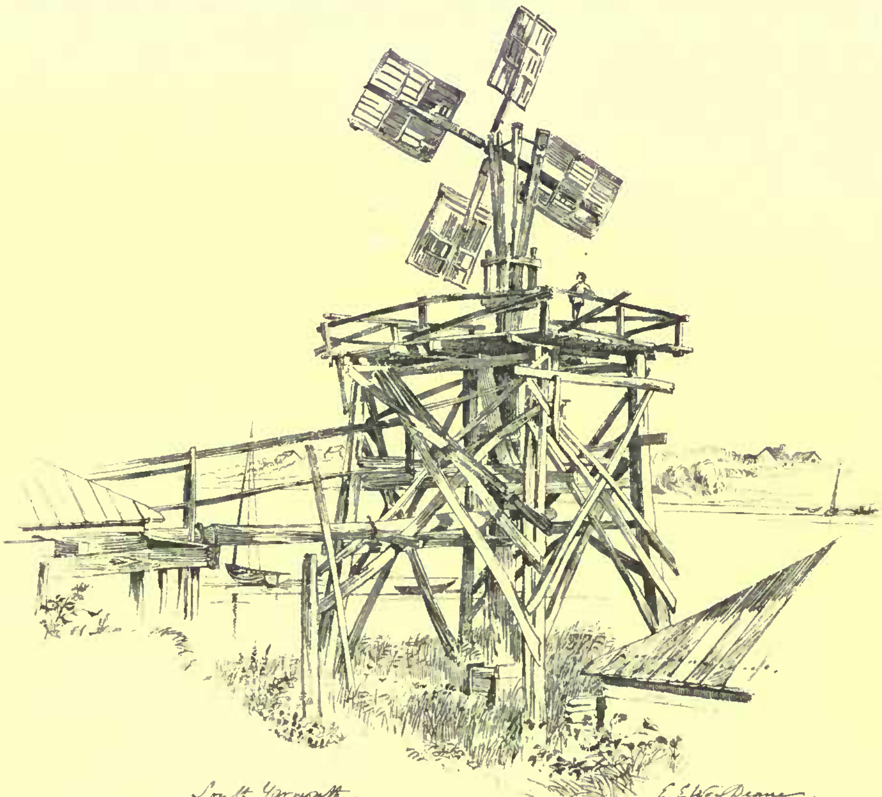
The quantity of sludge produced from a given quantity of sewage will vary according to local circumstances and conditions; such, for instance, as the character of the soil, the condition of the streets and roads, whether surface-water be wholly or in part admitted to or excluded from the sewers, whether manufacturing refuse is included in the sewage to be treated, whether or no the water-closet be in general use, and whether the process of precipitation be complete and efficient or only partial.

In a town where water-closets are in general use, where the soil is of gravel and sand, where surface water is partially admitted into the sewers, where there are no manufactories, and where precipitation is well and efficiently done with chemicals of moderate bulk, the proportion of pressed sludge containing 50 per cent of moisture, may be taken at six-tenths of a pound per head per day, or about 2 tons 14 cwt. daily per 10,000 of the population.

The principle is right: Consistent with efficiency, produce as little sludge as practicable, and this for two reasons: (1) that if it has any value, you secure its maximum value; whilst (2) if it has no value,

[1] A paper by Dr. C. Meymott Tidy, read before the Society of Arts, April 14, 1886, and published in the *Journal* of the Society. Continued from No. 577, page 33.

Cape . Cod . Sketches . No. 2.



South Yarmouth. Salt-Works

E. Eldon Deane.

"These Windmills pump the water into series of Tanks for solar evaporation and precipitation of the salt"

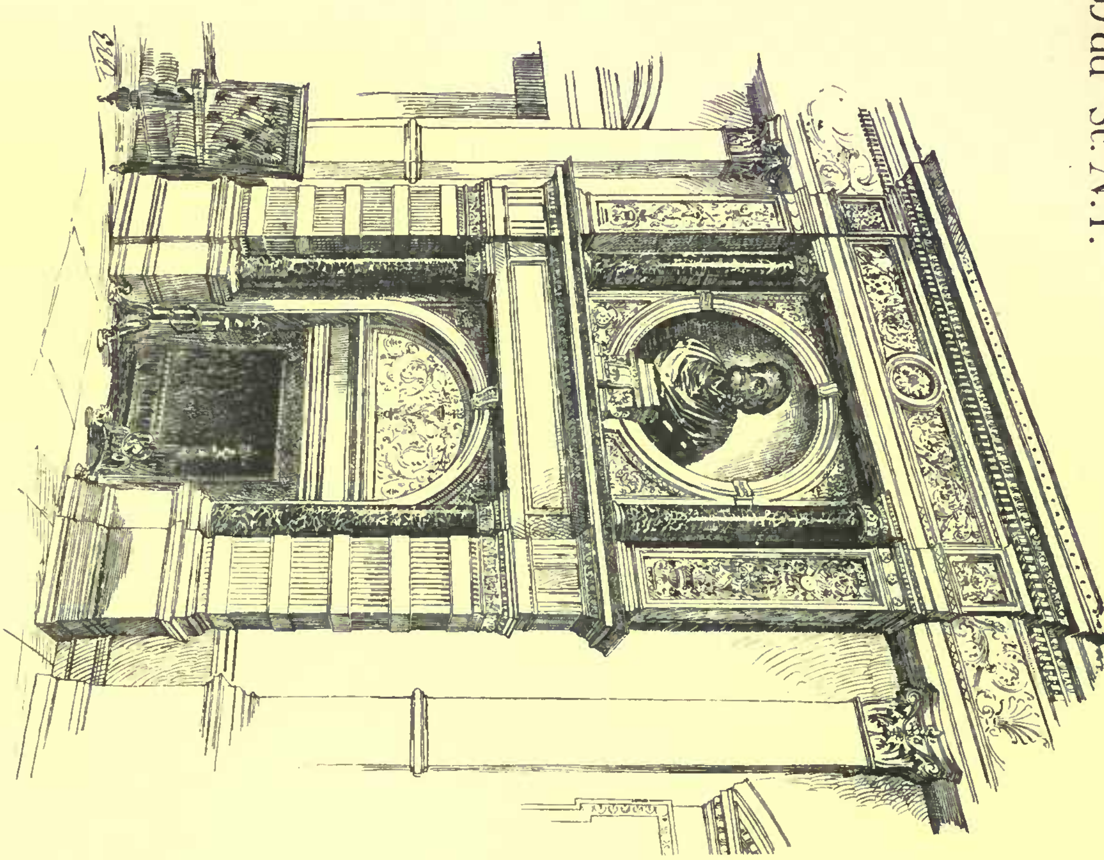


One of the Wharves of Provincetown.

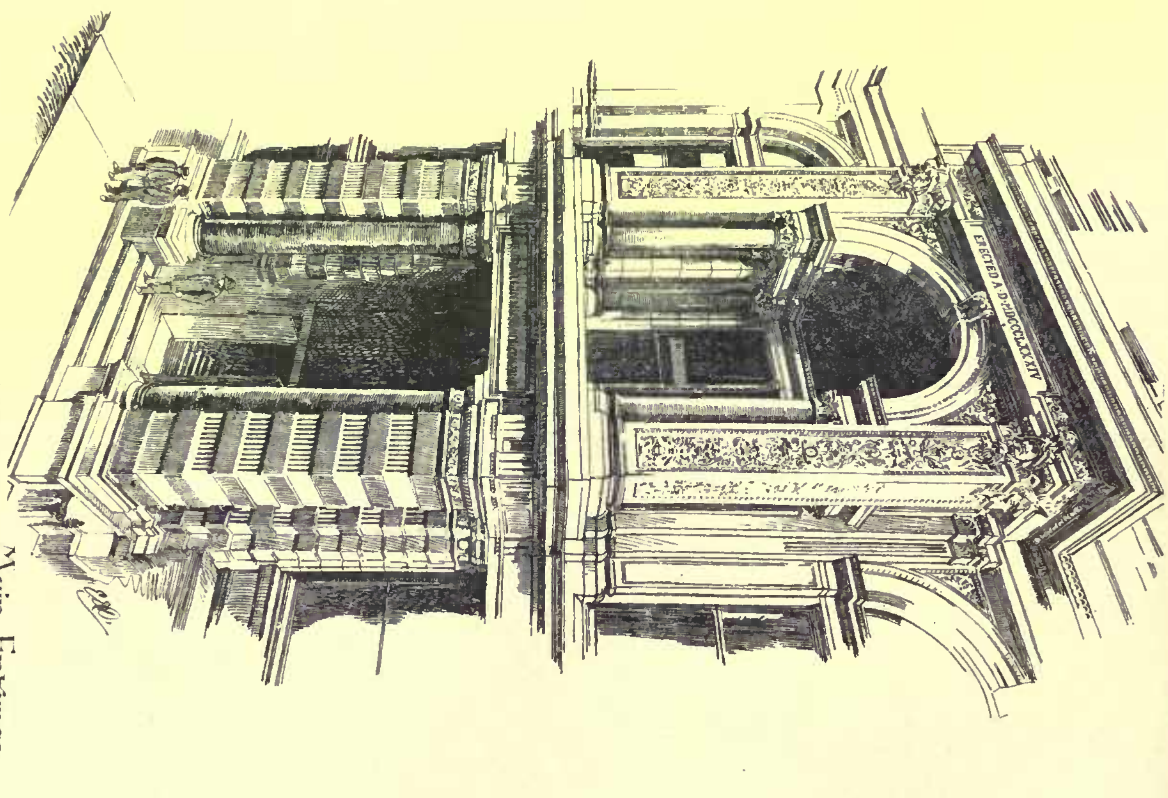
Heliotype Printing Co. Boston.

Building for the Mutual Life Ins. Co. of New York. on Nassau St. N.Y.

C. W. Clinton, Arch't.

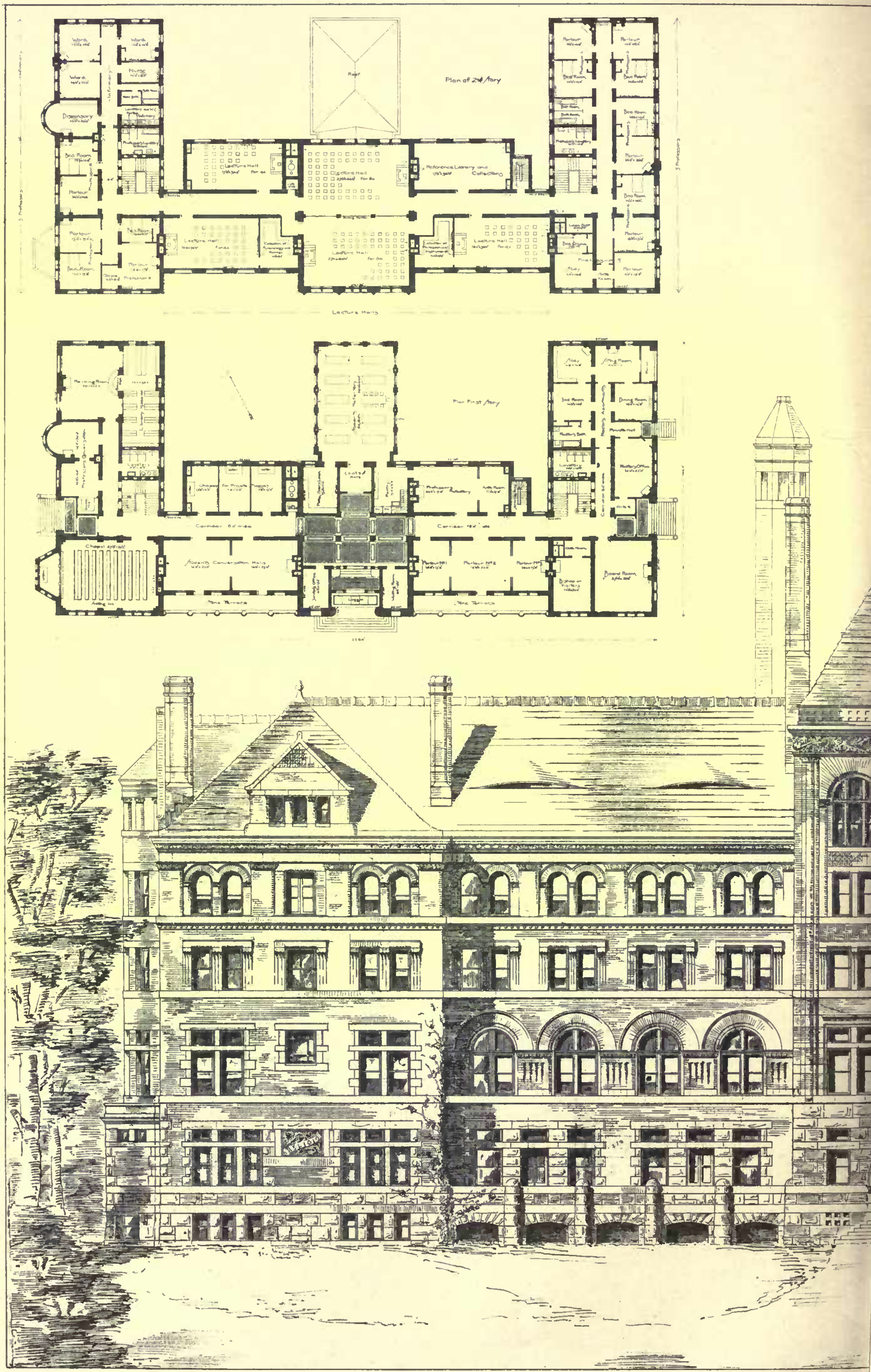


In Board of Trustees Room. *from Photograph*

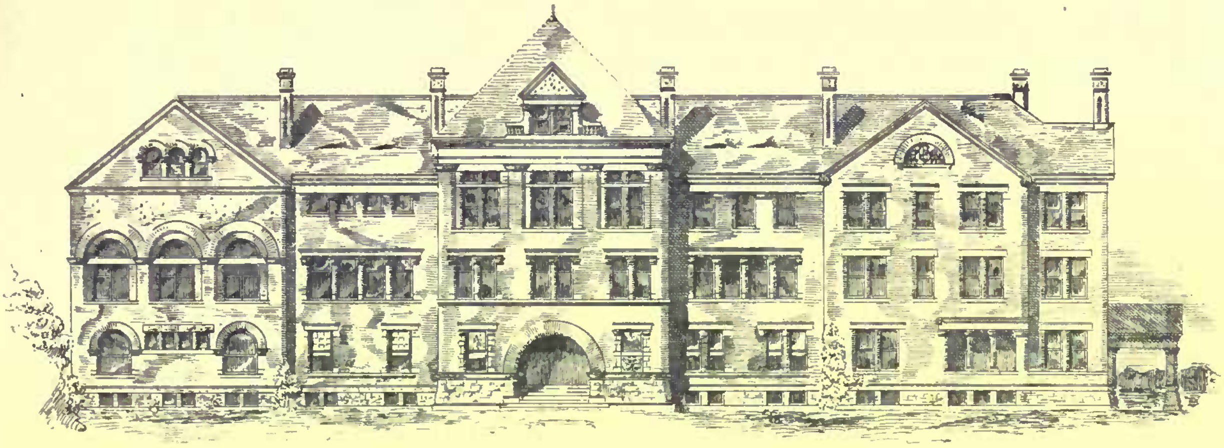


Main Entrance. *from Photograph*

Heliotype Printing Co. Boston


Plan of 2d Story
Lecture Halls
Plan First Story

OR & Co.



Alternative Design for

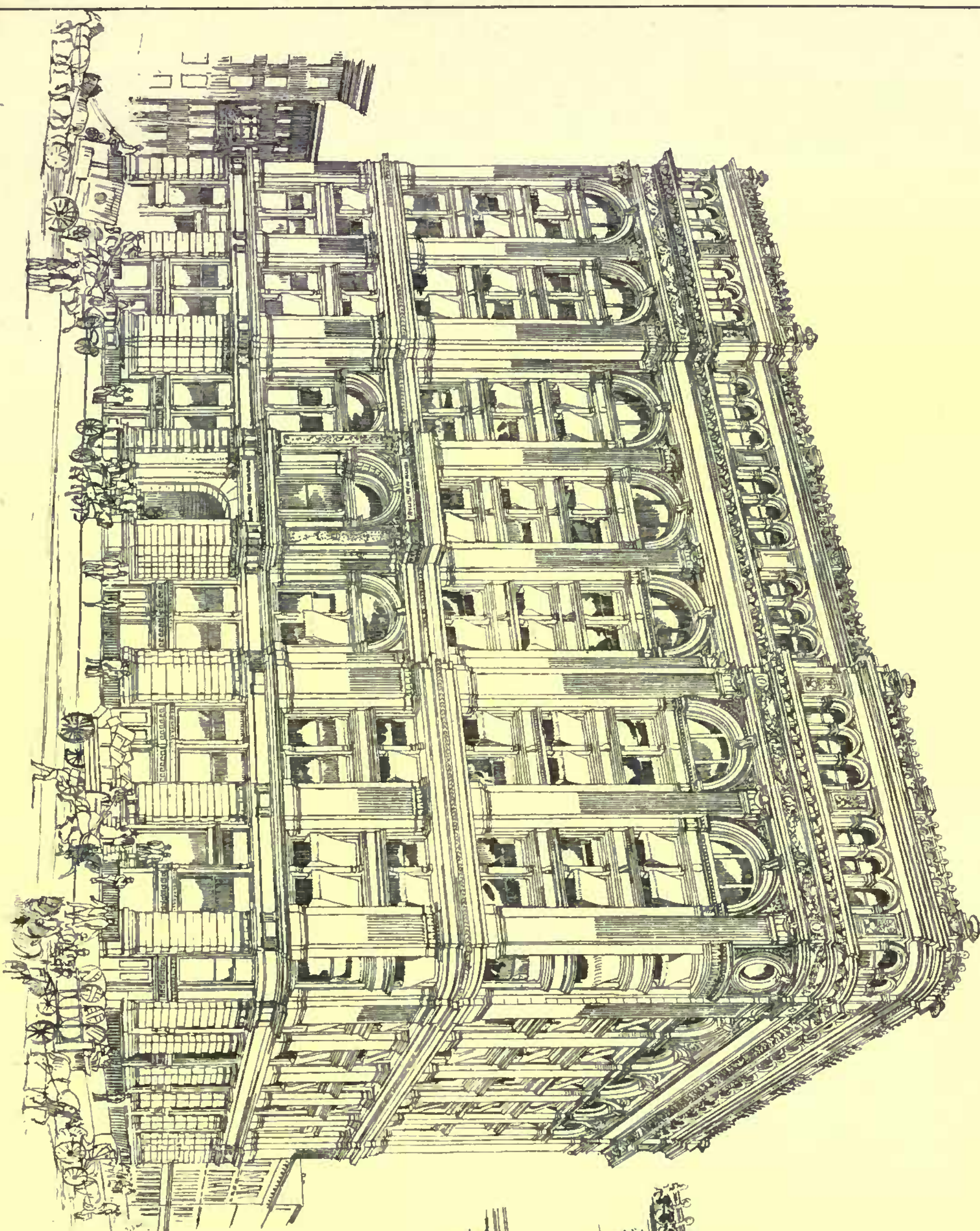
Design for
CATHOLIC UNIVERSITY at WASHINGTON D.C.
Front Elevation

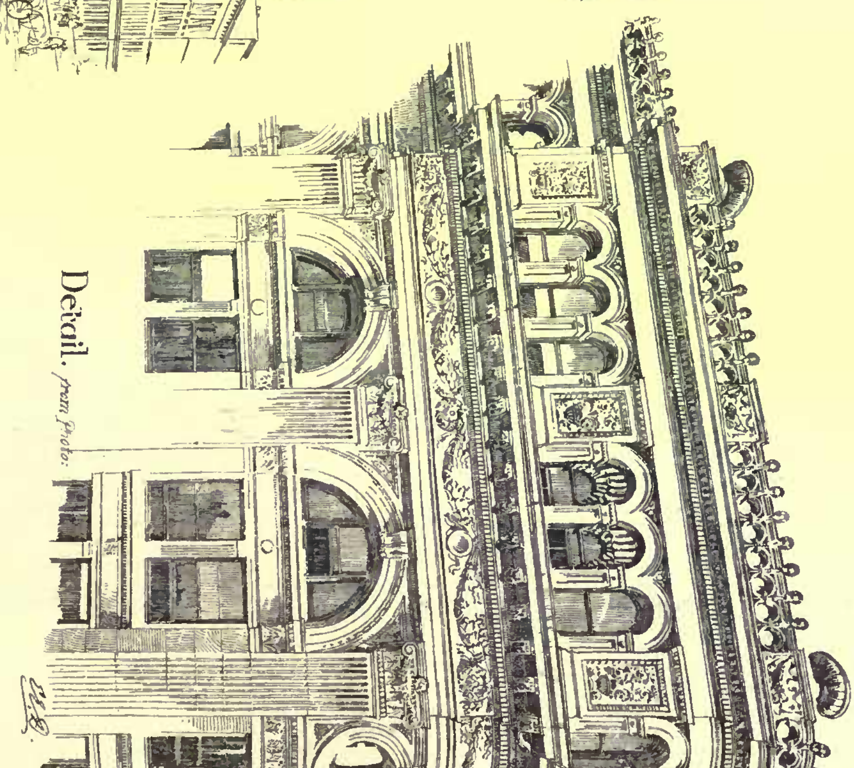
Scale 8ft.=1in. O. von Nerta. Archt



Heliotype Printing Co. Boston.

Building for the Mutual Life Ins. Co. of New York on Nassau St. N.Y.





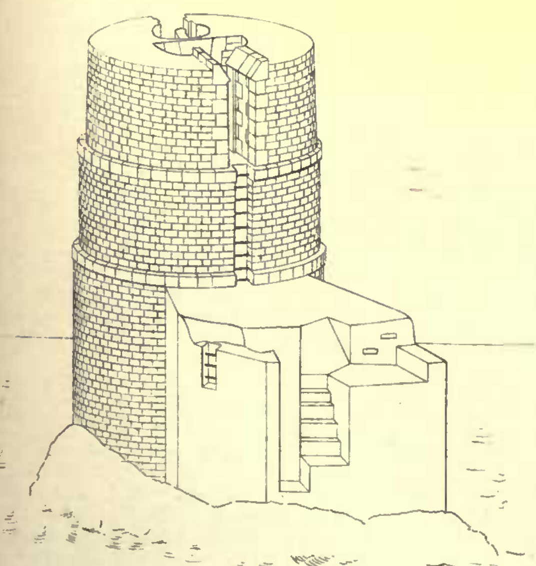
Detail. from photo.

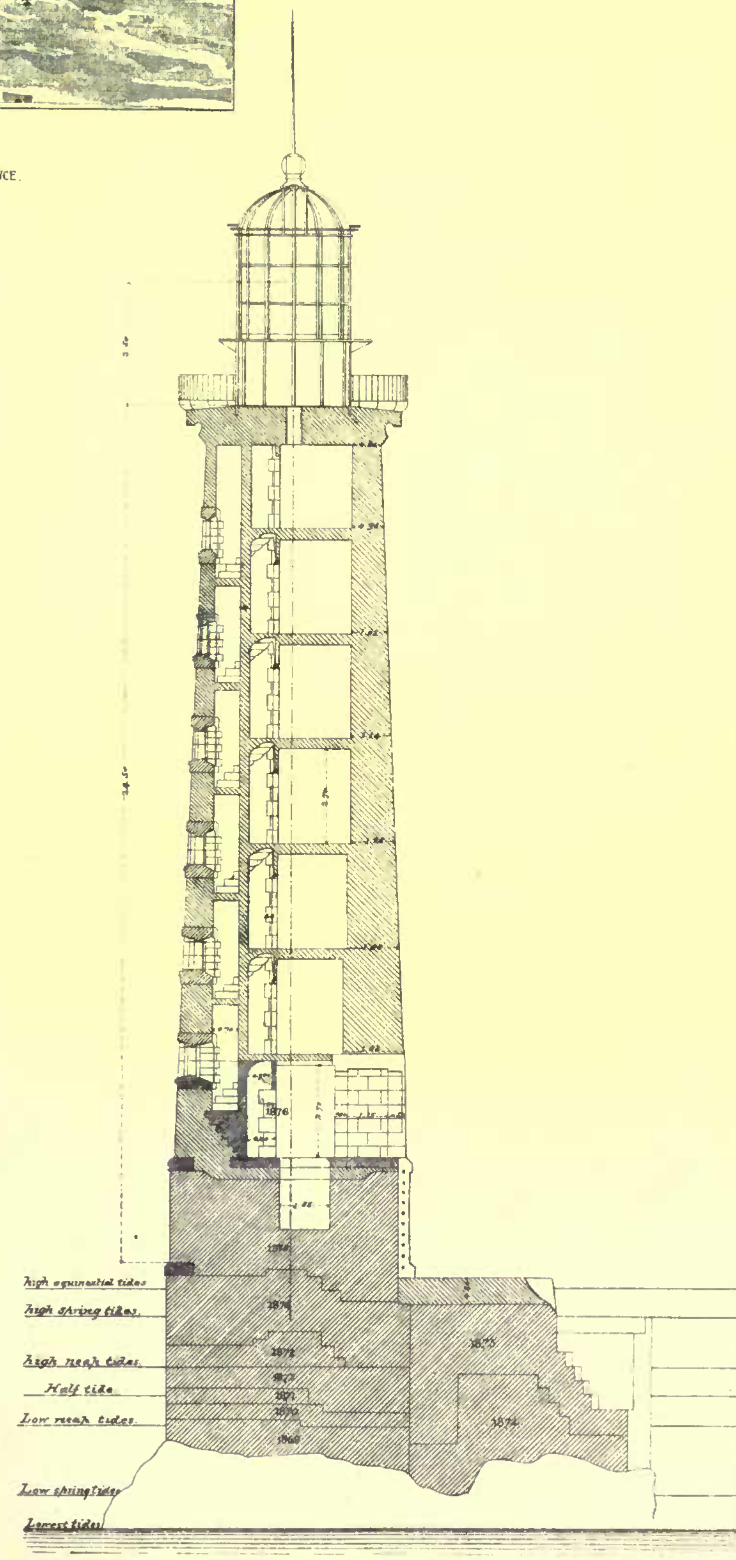
C. W. Clinton, Arch't.



LIGHT-HOUSE OF HEAUX DE BRÉHAT, FRANCE.

Condition of work
at the end of the season of 1876.





LIGHT-HOUSE OF AR-MEN, FRANCE.

Heliotype Printing Co. Boston.

you have the less to get rid of. Thus with some precipitants you get a large volume of valueless sludge. With sulphate of alumina you get comparatively little sludge, but a material of greater value. Of course it may be argued that the more sludge you obtain, the more perfect has been the removal of the impurities of the sewage. This may or may not be true.

II. — COMPOSITION AND VALUE OF SLUDGE.

I am anxious at once to say that I place no intrinsic value on the sludge whatsoever. An estimate of the value of sludge from different places has been given on high authority, but it is better to regard the sludge as a thing to be got rid of, and as a thing which, to be got rid of, must cost money and may not bring money. In the following Table the analyses of sludge from various places, and by various methods of precipitation, have been given by Dr. Wallace as follows:

ANALYSES OF SEWAGE SLUDGE (AIR-DRIED).

Name of Town.	Aylesbury.	Birmingham.	Birmingham.	Bolton.	Bradford.	Bradford.	Coventry.	Coventry.	Leeds.	Leeds.	Leicester.	Windsor.
Process of Precipitation.	A B C	Lime. 1	Lime. 2	Lime and charcoal.	Lime.	Lime.	Sulphate of alumina.	Sulphate of alumina.	Modified A B C	Hanson's process.	Lime.	Hillé's process,
Date.	1879	1879	1879	1879	1876	1879	1877	1879	1876	1876	1879	1877
Water	12.60	12.70	13.16	14.34	8.90	6.92	14.04	10.04	9.56	16.40	11.93	11.76
Organic matter, carbon, etc.	35.60	19.19	20.04	26.18	33.75	34.53	20.58	23.09	20.82	27.92	22.18	12.06
Phosphoric acid	2.11	.40	.72	.62	.80	.73	1.56	2.07	.75	1.21	1.21	.87
Sulphuric acid	2.70	1.45	.35	.61	.64	1.74	1.32	.56	2.15	1.02	.51	.49
Carbonic acid	..	7.62	8.53	8.30	10.53	13.77	6.64	5.71	8.42	13.11	15.25	22.71
Lime	2.18	11.19	12.74	14.50	16.90	20.27	9.16	6.65	9.68	17.51	20.16	31.09
Magnesia	.18	.90	1.37	1.06	1.66	5.07	.86	.61	5.64	7.67	1.48	1.58
Oxide of iron	6.20	2.70	3.20	1.98	2.11	2.01	4.14	2.66	4.61	2.32	2.66	1.68
Alumina	6.75	2.68	2.58	1.07	3.49	3.89	4.13	5.80	7.04	6.30	1.63	2.31
Sand, etc.	33.50	41.13	37.93	29.50	21.30	10.23	37.83	42.00	31.60	7.36	22 30	14.16
	101.22	99.96	100.62	100.06	100.58	99.16	100.26	99.16	100.16	100 36	99.31	98.71
Phosphate of lime	4.61	.87	1.57	1.35	1.74	1.59	3.40	4.52	1.39	1.64	2.64	1.90
Nitrogen	1.60	.52	.49	.61	.62	.66	.92	1.27	.66	.70	1.08	.52
Equal to ammonia	1.94	.63	.60	.74	.76	.80	1.11	1.55	.80	.84	1.31	.63
	s.	s. d.	s. d.	s. d.	s. d.	s. d.	s.	s. d.	s. d.	s. d.	s. d.	s. d.
Calculated value per ton.	33	10 9	11 5	13 4	15 1	15 4	20	27 2	14 2	17 2	21 7	11 5

A table by Dr. Voelcker on the estimated and market values of one ton of sludge from places stated is given below.

ESTIMATED AND MARKET VALUES OF ONE TON OF SLUDGE FROM PLACES STATED (VOELCKER).

	Estimated or theoretical value.[1]			Practical or market value.[2]
	£	s.	d.	s. d. s. d.
1. Bolton sludge (M and C process)	0	9	8¼	3 3 to 4 10
2. Bolton sludge, 15 per cent of moisture	1	1	1	7 0 to 10 6
3. Bradford sludge before lime was added	0	11	0¼	3 8 to 5 6
4. Bradford sludge with 15 per cent of moisture	0	19	3	6 5 to 9 6
5. Bradford sludge after treatment with lime	0	4	8	1 6 to 2 4
6. Bradford sludge with 15 per cent of moisture	1	0	0¼	6 8 to 10 0
7. Aylesbury, A B C sludge	0	8	4½	2 9 to 4 2
8. Aylesbury, A B C sludge with 15 per cent of moisture	0	16	8¼	5 6 to 8 4
9. Coventry sludge of General Sewage Manure Co.	0	16	9¼	5 6 to 8 4
10. Rochdale manure	0	15	11¼	5 4 to 8 0
11. Halifax manure by Goux's process	0	17	7	5 10 to 8 9

The old system consisted in merely placing the sludge in pits, and allowing it to air-dry. In this condition it was sold or given to the farmers. I may mention here that a sludge containing 90 per cent of moisture can be reduced to 80 per cent by forty-eight hours' draining, to 75 per cent by three days' draining, and to 71 per cent after a week's draining. After this, air drying is comparatively slow, although no doubt the admixture of porous substances would render drying more rapid and more complete.

III. — DISPOSAL OF THE SLUDGE.

1. *Johnson's Process.* — By this process the liquid portion of the sludge is extracted by pressure in a series of compartments. Each compartment is provided with a canvas cloth, which acts as a strainer, and retains the solids as the liquid passes through. The sludge is driven into the compartments by compressed air, 100 to 120 lbs. per square inch, until they can hold no more. On opening the press, a solid cake of compressed sludge is found in each compartment. The cake is compact, easily handled, and practically has no smell. It has a certain manurial value.

It is worth while to consider a few details of pressing. The sludge, as precipitated, contains on an average 90 per cent of water, whilst the pressed sludge cake contains 50 per cent. By simple air drying, the 50 per cent of moisture may be reduced to less than 20 per cent. Thus, in every ton (2,240 lbs.) of unpressed sludge, 2,016 lbs. is moisture, and 224 lbs. solid matter. After pressure, the 224 lbs. of solid matter holds about 224 lbs. of moisture, the removal of 1,792 lbs., or about 179 gallons of water having been effected. The time occupied in the compression of 5 tons is about one hour. The sludge cake, according to Monro, contains from 0.6 to 0.9 per cent of nitrogen, and over 1 per cent of phosphoric acid. It has been the practice to run back the liquid expressed from the sludge into the sewer, to be re-treated. Professor Dewar and myself have pointed out that this course is unadvisable. The liquid thus expressed is exceedingly foul, although perfectly clear, and does not readily lend itself to ordinary chemical precipitation. I will merely note that it requires separate treatment, and that our experiments indicate chloride of lime or perchloride of iron in larger amount than is required for ordinary sewage may be rendered effective for the purpose.

The manurial value of the pressed sludge cake from Coventry, Leyton, and West Ham, has been the subject of careful investigation by Dr. Monro, from whom I have abstracted the percentage details of experiments on the dried sludge given in the next table.

The phosphoric acid in sewer sludge is chiefly in combination with alumina. Dr. Monro notes that whilst Coventry sewage contains much manufacturing refuse from dye-works, and West Ham sewage the refuse from industries of a most varied and polluting character, Leyton is a rural and suburban district, having no manufactures of any kind contributing to the sewage.

PERCENTAGE DETAILS OF EXPERIMENTS ON THE DRIED SLUDGE.

	Coventry sludge dried. Precipitants, lime and sulphates of alumina and iron (filtration).	Leyton sludge dried. (Precipitants like Coventry.)	West Ham sludge dried. (Precipitants, sulphate of alumina and lime.)
Organic matter	26.14	26.08	40.32
Containing nitrogen	1.36	1.35	1.82
Potash	0.30	0.34	0.22
Total P_2O_5	2.43	2.04	2.57
Soluble P_2O_5	1.37	1.69	1.24

Dr. Monro has practically tested the agricultural value of these pressed sludge cakes, for the details of which the reader is referred to his original paper. Good crops of swedes were obtained. The three sludges gave almost identical results as regards yield. The following were the results obtained by him with different dressings for comparison:

RESULTS PER ACRE.

	Tons.	Cwt.
1. 10 tons farm-yard manure	13	11¼
2. 4 cwt. superphosphate	11	2¼
3. 5 tons Leyton sludge	10	4
4. 5 tons farm-yard manure	10	1¼
5. 5 tons West Ham sludge	9	8¾
6. 5 tons Coventry sludge	9	6¾
7. 2 cwt. superphosphate with 2 cwt. of nitrate	9	5¼
8. 2 cwt. superphosphate	9	4¼
9. 2 cwt. coprolite	8	15¼
10. 4 cwt. coprolite	7	10
11. Unmanured	5	18

From the details it is evident that the air-dried filter-pressed cake has a certain manurial value — at any rate, about equal to farmyard manure, — which possibly, considering how easily it may be stored without causing a nuisance, may be worthy of being considered more fully than it has at present. It is worth noting that, although the newly-pressed cake is richer in nitrogen than farmyard manure, and contains more than double the amount of phosphoric acid, still that the manurial value is not greater, weight for weight. This Dr. Monro explains by differences of physical condition, viz., the loose texture of farmyard manure compared with the compact condition of the sludge-cake; the physical state of the one being as favorable to rapid oxidation and disintegration as that of the other is unfavorable. To overcome this difficulty, Dr. Monro suggests the reduction of the cake to a fine state of subdivision.

The cost of procuring the sludge is stated by Mr. Hutchinson (to

[1] Calculated on the supposition that phosphate of lime is worth 1*d*. per pound; potash 2*d*., and nitrogen (as ammonia) at 8*d*.

[2] By this is implied its value as compared with good farm-yard manure, which has a theoretical value of 15*s*. 7*d*., its market value being from 5*s*. to 7*s*. 6*d*. per ton.

whose excellent paper I must refer) as from 2*s.* to 2*s.* 6*d.* per ton at Coventry. I have no records as to what the further cost of grinding would involve.

The Johnson process is at work at Croydon Rural, High Wycomb, Coventry, Leyton, Blackburn, and Aylesbury.

2. *Major-General Scott's Process.*—This is adopted at Burnley. The lime-precipitated sludge (*i. e.*, lime and organic matter) is drained until it contains about 65 per cent of moisture. The sludge at this stage is tested as to the amount of lime present, more being added if necessary. The mass is now dried by heat, and finally burnt in kilns. The residual clinker is ground, and used as an hydraulic cement (Portland cement). The cement is said to have a tensile strength of 350 lbs. per square inch after immersion in water for seven days, and to be worth 35*s.* per ton.

It is evident that the composition of sewage sludge varies not only in different towns, but in the same town at different times. It is not quite clear how far this process can be worked so as to secure that which engineers know to be so important, viz., a cement of constant character. (See paper by Granville Cole, Ph.D., Society of Arts Conference, 1879, p. 137.)

The cost of drying is 7*s.* per ton. The coke employed for burning averages 1*s.* 4*d.* per ton, and the labor, etc., 15*s.* per ton.

Major Scott has suggested that in the case of the London sewage both a manure and a cement might be prepared.

In the *Journal of the Society of Arts*, November 28, 1879, he suggests, in the treatment of the sewage, that the primary separation of the coarser mineral suspended matter should be effected in a first tank, a sufficient period of rest being afterwards allowed for the subsidence (not the artificial precipitation) of the lighter suspended matters in a second tank. The sludge of this second tank (*i. e.*, after the watery portion has been drawn off) is to be treated with about two-thirds its weight of milk of lime, sufficient superphosphate being afterwards added nearly to neutralize the lime. (The superphosphate is to be prepared by mixing 20 cwt. of Cambridge coprolites with 17 cwt. of brown sulphuric acid, sufficient water being added to render the mixture almost fluid). By this treatment the mixture (he states) becomes surprisingly inodorous, and dries with rapidity. The cost of chemicals he values at 16*s.* 6*d.* per ton of prepared manure, its removal from the tanks and subsequent drying being 3*s.* 6*d.* He considers it worth £3 10*s.* per ton of prepared manure. The sewage, or liquid portion of the second tank, from which the organic matter has been recovered, is then to be treated with lime, and the precipitate thus obtained made into a cement.

Major Scott seems to have overlooked the difficulty of effecting precipitation of the suspended matters of sewage (such as he is desirous of obtaining in the second tank) without the use of precipitants. Further, a limed sludge, when dried, is certain to lose ammonia, in other words, is certain to lose manurial value.

The deposit in the first tank, Major Scott proposed, should be burnt in a destructor with waste cinders, and be used to reclaim a portion of the marshes. At any rate (he justly considers) it ought not to be allowed to pass into the river.

3. *Destructor.*—The destructor has been carried to its greatest state of perfection at Ealing, under the ingenious and careful management of Mr. Charles Jones. In this case, however, the ashes of the district are mixed with the sludge. The chemicals used for precipitation are 11.5 grains of clay and about ten grains of lime per gallon, a little iron and alumina being also used. The sewage treated comes from a population of about 18,000, and is equal to 600,000 gallons daily. About 157 cubic yards of sludge are obtained per week. This is mixed with about 100 cubic yards of ashes and house refuse. Before the mass is burnt in the destructor, about 25 per cent of the liquid portion is allowed to drain away.

It may be advisable here to note the difficulties that have been met with generally in the use of destructors:

1. An escape of vapors that prove more or less offensive at a considerable distance from the shaft. This depends on the materials having undergone incomplete burning, in other words, that the materials in the destructor have been subjected to destructive distillation (in which case the products, consisting of various empyreumatic vapors are offensive) rather than combustion, in which case the products would be simply water and carbonic acid, and inoffensive. No doubt, until lately, the escape of unburnt and partially burnt vapors, a very small quantity of which sufficed to cause a nuisance, have proved a serious objection to the use of destructors.

2. The escape from the shaft of unburnt or partially-charred paper, fine sand, etc., at certain stages of the process.

I do not hesitate to say that both of these difficulties are met in Jones's destructor. This has been done by mixing the sludge with the house ashes, thus assisting effective combustion. Mr. Jones lays down that every town supplies sufficient house refuse to burn its sludge. The main point, however, on which he relies, is the construction of a muffle furnace (a fume destroyer, as he calls it) between the furnace and the main shaft. As a result, not only is a greatly-increased draught secured, but the combustion of unburnt vapors discharged from the furnace in which the sludge is placed is secured. I may add that Mr. Jones informs me that the muffle furnace is kept going at a cost of 1*s.* 6*d.* per day, but that this, in addition, gives 10 lbs. of steam for engine purposes. He obtains, as a residuum from the furnace, 25 per cent of hard clinker, which is utilized in various ways, viz., for artificial stone, road-making, etc.

Various suggestions for what may be called fortifying the sludge have been suggested. Thus, Colonel Jones, of Wrexham, after drying the sludge to 20 per cent of moisture, adds to every 12 parts 7 parts of raw bone-meal and 1 part of sulphate of ammonia.

I do not propose discussing other suggestions for the disposal of sludge, such as the separation of the water by centrifugal machines—converting the sludge into a fuel by admixture with other waste products—its conversion into a combustible gas—making it into bricks, etc. (Monson). These suggestions are scarcely practical.

The question of cost must be considered in conjunction with (1) the quantity of the sewage, (2) the quality of the sewage (that is, the nature of the sewage other than mere excreta), (3) the flow per head, and (4) the standard of excellence required.

As regards quantity, I wish to say that you cannot apply the cost of treating small volumes of sewage to the cost of treating large volumes, the treatment of the former being more easily effected than the latter.

PRICES OF CHEMICALS.

Green copperas or proto-sulphate of iron can be obtained for about 20*s.* per ton.

Lime can be obtained from 10*s.* to 15*s.* per ton.

Sulphate of alumina can be obtained for 46*s.* 6*d.* per ton, as per following analysis:

Moisture	5.94
Crystalized sulphate of alumina	77.44
" sulphate of iron	4.00
Sulphates of alkalies and sulphuric acid	6.82
Insoluble iron and alumina	5.80
	100.00

The annual cost of thoroughly and efficiently treating the sewage of Coventry, pressing the whole of the sludge, etc., exclusive of interest on plant, land and depreciation—the population contributing being 45,000 persons, and the sewage containing large quantities of dye and manufacturing refuse—is £2,800 per annum, an amount equal to 1*s.* 3*d.* per head.

The cost at Hertford, where the sludge is not pressed, and manufacturing refuse is absent, with a population of 7,747, is £570 per annum, equal to 1*s* 5½*d.* per head.

A few words only on the analysis of sewage. No single analysis of a sewage effluent is satisfactory as proof of good or of inefficient working. Knowing as we do that sewage varies from hour to hour, no accurate conclusion can be drawn as to the composition of the raw sewage or of the effluent, except by collecting half-hourly, or at least hourly, samples during one entire period of twenty-four hours, and the various samples mixed in the proportion of the fluid. The analysis of a sample of raw sewage and of an effluent taken about the same time are not comparable, because the passage of the sewage through the tanks is commonly the work of some hours. Supposing, for example, I collect a sample of twelve o'clock sewage and a sample of effluent at the same time, the twelve o'clock sewage may be the very strongest sewage of the day, whilst the effluent sample is the effluent of the very weakest sewage. Precisely the opposite conditions may occur, viz.. that I may compare the effluent of the strongest sewage with the weakest raw sewage delivered.

Further, in all cases where analyses are made for test purposes, the weather should be noted, the rainfall and the flow being compared with the average flow. For accurate purposes a normal condition of flow should be selected, and comparison made between the average of twenty-four hours' sewage and twenty-four hours' effluent.

As regards the analysis of sewage, it is advisable to estimate the quantity of the matters in suspension, and in these the amount of mineral and organic (with volatile) matters. In addition to this, I have of late adopted the system of estimating the organic carbon and nitrogen, and the oxygen required to oxidize the organic matter in the effluent without removing the suspended matter. Seeing that the real issue is the condition of the effluent, I consider this method preferable to an analysis of the clear effluent after the removal of the suspended matter.

I propose the following form as one which conveys the best information that chemistry can afford as to the chemical composition of a sewage and of an effluent:

The results are stated in grains per imperial gallon of 70,000 grains.

Matters in suspension—Total ....
(*a*) Organic and volatile ....
(*b*) Mineral ....

The following details have been obtained from the effluent without the removal of the suspended matters:

Total solids (suspended and dissolved) ....
Ammonia ....
Chlorine ....
= Chloride of sodium ....
Nitrogen (as nitrites and nitrates) ....
Oxygen required to oxidize organic matter
Organic carbon ....
Organic nitrogen ....

To get rid of excretal filth with the least possible delay is no doubt the teaching of sanitary science. The advocates of the water-closet urge that water as a vehicle to carry the refuse commends itself to us on the ground of convenience, cleanliness and cheapness. They

would compare, with plausible argument, the natural power of gravitation (such as is made use of in the water-closet) with an organization of men and carts (such as is required by the dry-earth system). The advantages, at first sight, seem all on one side. Facts, however, point in an opposite direction. Dilution with water is the best known method of rendering practically useless whatever is valuable in sewage — indeed, worse than useless, an ungovernable nuisance. The excreta of animals are no doubt intended for the food of plants, and for our use through their intervention. Of course, do what we will, nature will assert herself and her plans. But nature is embarrassed by our meddlesomeness. The nutritive food of the plant we drown in water, our ingenuity failing when we attempt to deal with the filthy mixture. We cannot utilize it, unless we abandon all sanitary precautions; it pollutes our air, renders our ground a stinking morass, and defiles our water-courses. Thirty gallons of water daily per head is brought to us who live in London, from pure sources, at great cost, and with great engineering skill; filtered, often refiltered, with extraordinary care; stored with scrupulous anxiety; analysed by one chemist after another. It is, however, a striking fact that only one-ninetieth part of the entire water-supply is used for drinking purposes, a large quantity being destined to become the diluent of our sewage, to perplex us by its quantity, to bother us by its uselessness, and to steal our health by the perpetual nuisance it occasions.

I desire to acknowledge my indebtedness in the preparation of this paper to numerous friends. Amongst others I cannot forbear mentioning Professor Dewar, Mr. Hawksley, Mr. Mansergh, and Mr. Melliss.

[The end.]

FIRE AND LIFE RISKS IN ELECTRIC LIGHTING AND TRANSMISSION OF POWER.[1]



AT the regular meeting of the Electric Club held in New York on the evening of November 4, Dr. Geo. H. Benjamin, a member of the executive committee, read a paper on the above-named subject. At its conclusion a Colonel Morrison, the representative of an electrical company, pronounced the statements contained in the paper exaggerated and untruthful, whereupon considerable excitement in the club ensued. This prevented the consideration by the club of the rules submitted by Dr. Benjamin. We present herewith the full text of the paper, with the rules submitted by Dr. Benjamin:

In 1882, the Board of Fire Underwriters of the City of New York adopted a series of rules relative to the precautions to be observed in the introduction of the electric-light into buildings, and which were published at the time, and with which you are all doubtless familiar.

However well these rules may have been suited to the date of their promulgation, I believe it will be generally admitted that they are unsuited and inadequate to the present needs. With all new industries or the practice of new arts, it has been the rule to allow the utmost latitude and to impose as few restrictions as is possible compatible with public welfare, this with the idea of lending encouragement and facilitating the introduction of such new art or industry; but when after a time the industry or art has become well understood and established on a firm commercial basis, further and supplemental restrictions are generally imposed with the intention of making the employment of such art or industry absolutely safe for all concerned, those engaged in the practice thereof, as well as those using or being benefited thereby.

When the dangers arising from the employment of electric currents of such quantity or electro-motive force, as are required in electric-lighting, were first pointed out through the medium of the public press, there was a great hue and cry raised by those engaged in the business, and unstinted abuse was heaped on the heads of the unfortunates who had dared to have the temerity to advance such radical ideas. Time works wonders, and I doubt not that to-day, even those employed in the business of electric-lighting, see and feel the necessity of precautionary rules, and likewise the advisability of their most rigid enforcement. If any one present sees fit to question my premises as stated, I would respectfully refer them to the disastrous fires and terrible accidents which have been lately recorded in the daily press — fires which caused the destruction of large amounts of valuable property, accidents by which men were unnecessarily deprived of life. I say unnecessarily as regards life, as the possibility of such slaughter should be guarded against by absolute prohibition, and if necessary, by statutory enactment, making it a penal offense to direct or employ men, however experienced in that class of electrical work, where the slightest oversight or unavoidable slip means sure and instant death. Some of you may be inclined to argue that employers should not be held responsible for the carelessness and negligence of their men; that the men seek the employment well knowing the terrible dangers to which they will be subjected. To them I say that the root of the matter should be sought. The struggle for existence and the difficulty in obtaining employment at the present time is a most potent factor in causing those in need to seek and obtain situations, however great the risk entailed. If the remedy were directed toward the fountain-head, and the principal or management of the company employing such dangerous currents were held personally responsible, then they would make it their business to see that no unnecessary risks were entailed, and they would in effect become guardians of their men. That familiarity breeds contempt is an old saw, and to warn the average electric-light line man or machine attendant to be careful is sure to provoke a derisive smile. "All right, I'll look out for myself," was the answer of an old and experienced employé in a Western city a few weeks since. In less than two minutes thereafter he was stone dead. Thought the circuit was open. If the president of the company had been fully aware that he would be held responsible for such an accident, he would have seen to it that the circuit was open, and a human life would not have been needlessly sacrificed. Some may argue that there are occasions when it is impossible to open the line without serious loss or public inconvenience, and that repairs may become necessary when the line is in full operation. To those I say that there can no occasion arise in which an employé must necessarily risk his life. What does it matter if one, twenty, fifty or any number of lights be cut out? Nothing compared to a human life, and particularly as I maintain that no condition can arise where the necessity of cutting out any such number of lights is obligatory.

When a man, under our laws, is tried for his life, the law presumes him innocent. There are many cases on record where hundreds of thousands of dollars have been expended to save the lives of men probably not as worthy as either of the two poor fellows lately so wantonly slaughtered. More money, yes twice over, than would have been required to buy out and obliterate the electrical companies owning the plant which caused their death. The good of the many (the public) may at times require the sacrifice of the lives of the few, but the good of an electric-light company is not the good of the public, and it is incomprehensible that a mere commercial concern should be allowed, by gross carelessness or ignorance, to sacrifice the life of even the meanest of human beings. Therefore, I contend that stringent and prohibitory means should be adopted to make such accidents in the future an impossibility, and further, that such rules should have the cordial support of every one having the true interest of electric-lighting or the transmission of power at heart. So far as the risks from fire are concerned, it is not necessary to enumerate them. Unfortunately, sad experience has made them only too well understood. Careless, stupid, and one may say criminally loose methods of wiring, have been the rule rather than the exception in this country. Of course, with some notable exceptions, and all those who have carefully studied the subject, and are conversant with the needs, feel that the enforcement of proper and stringent rules will not only allay public fears and restore confidence, but likewise materially benefit the industry.

I contend, gentlemen, that we should look upon this subject in a broad light, and free from the narrow prejudice of business. We should recognize the necessity and not attempt to evade the responsibility. To make an electric-plant perfectly safe may necessitate slightly increased cost of construction — although personally, I am inclined to doubt the fact. But even admitting such to be the case, the perfect immunity from danger, the increased cost of insurance, and the general confidence engendered in the public mind, will be a good interest upon such additional outlay.

The rules which I would submit to your consideration are as follows, and have been written after a careful examination of the rules of all the fire-boards and underwriters' associations of the world. I have endeavored to make them as concise and clear as possible, and with the intention of providing as few onerous conditions as are compatible with absolute safety to life and property. Such rules are comprehended under the headings: (1) Rules to be observed in conveying currents of considerable quantity or electro-motive force in and through buildings. (2) Rules to be observed in locating and constructing aerial and underground conductors. (3) Rules to be observed to prevent accidents to life or bodily injury.

I. — RULES TO BE OBSERVED IN CONVEYING CURRENTS OF CONSIDERABLE QUANTITY OR ELECTRO-MOTIVE FORCE IN AND THROUGH BUILDINGS.

1. The degree of E. M. F. that may be employed in an electric circuit within any building should not exceed one hundred volts for alternating currents, or two hundred volts for continuous currents. No departure will be allowed from this rule except by special permit, and then only for arc installations in large buildings where the whole plant is absolutely removed from public interference.
2. The conductivity of all wires should be such that one hundred per cent more current can be transmitted through them than that estimated as their proper carrying capacity, without increasing their temperature above 150° Fahrenheit.
3. No naked conductors allowed in buildings.

[1] A paper read before the Electric Club, November 4, by Dr. Geo. H. Benjamin.

4. All light and power circuits must be entirely metallic, and of properly insulated wire. The employment of gas, water or steam-pipes, or the earth as a part of circuit, is positively prohibited.
5. All conductors should be thoroughly well insulated with a material or materials as non-inflammable as possible, and which will not fray or become loose, melt at a low temperature (below 150° Fahrenheit) or absorb moisture.
6. All conductors that are exposed to moisture, must be provided with a waterproof insulated covering.
7. Where practicable, all conductors in factory or similar buildings shall be so placed as to be readily inspected and tested.
8. No conductor, whether bare or insulated, shall be laid in wet cement, plaster, mortar, or other similar material.
9. All conductors carried through or within walls, floors or partitions, must be inclosed in separate metal, earthen-ware, terra-cotta or asbestos-board tubes, or their equivalent, and which should be slightly larger in their inside diameter than the conductors they are designed to carry. Conductors should not be placed above each other in such a manner that water could make a cross section. Especial care should be taken to protect all concealed wires from mechanical injury.
10. Conductors conveying currents of considerable E. M. F. or quantity as for arc-lights, power, charging of storage-batteries and the like, excluding secondary distribution, should be placed at least six inches apart, the same distance from conducting bodies, and at least two feet from other wires of smaller diameter placed parallel therewith.
11. Conductors conveying alternating primary currents of high E. M. F. must be kept a minimum distance of twelve inches from each other and inclosed in separate highly-insulating fireproof casings.
12. Conductors conveying currents for incandescent-lighting, and having a less E. M. F. than two hundred volts, and running along walls or other exposed supports, should be placed at least two-and-one-half inches apart and a similar distance from all other wires or metallic bodies, except as provided in Rule 9.
13. Conductors for arc or incandescent lighting currents should be placed in grooved mouldings, or casings of wood or dry plaster or like material, preferably arranged along the cornice line, and in such case there should be a septum of the wood or material, having a thickness of three inches for arc currents and one-half of an inch for incandescent currents between the wires. Wooden mouldings may be rendered fireproof by painting them with a solution of tungstate of sodium in water.
14. Single or twin wire insulated conductors may be carried through electroliers or gas-fixtures, but especial care must be taken to insulate such conductors from the metal parts of the fixtures.
15. The location of all concealed conductors should be plainly designated by an appropriate mark.
16. No metallic staples, nails, hooks or devices for attaching and supporting electrical conductors should be employed in buildings. Wooden cleats or porcelain saddles must be provided. Two conductors conveying high potential currents should never be included in the same saddle or cleat.
17. Twin insulated wires may be employed in branches feeding single incandescent lamps in parallel of the main circuit.
18. All joints should be mechanically and electrically perfect; the ends cleaned, united by solder (resin flux employed) and wrapped with insulated tape.
19. Safety fuses should be provided at both points of junction of a branch circuit with a main circuit, and the conductivity of such fuses should in no instance exceed fifty per cent of the current designed to operate the devices in circuit.
20. Where practicable, all safety fuses for each room should be placed in a conveniently located fireproof box, so that they can be inspected or renewed without inconvenience or injury to the premises.
21. A cut-out switch which can be operated by the firemen or police must be placed in the circuit in a well-protected and accessible place.
22. Magnetic cut-outs or circuit-breakers should be used in preference to fusible strips on arc or power circuits, and should be adapted to be thrown into action by any increase of current amounting to fifty per cent or less, as specially required.
23. Magnetic cut-outs, for use in secondary distribution circuits should have double poles and be arranged to act at twenty-five per cent above the normal current, and be placed as near the entrance of the primary conductors into the building as possible.
24. Where incandescent-lights are run on arc-light circuits, fastening or attaching lamps to any gas or other metallic fixture which may be in electrical connection with the earth is prohibited.
25 Distributor boxes from arc-light circuits must be convenient for access-kept free from moisture and dust, and as far removed as is possible from other electrical devices, pipes, metal, etc., or earth connections.
26. Distributor boxes must not be placed in any circuit wherein the E. M. F. of the current transmitted exceeds one thousand volts.
27. Distributor boxes must be arranged to automatically cut out the arc current, should any defect arise or accident occur either in box or incandescent circuit.
28. In working distributors, an ampere-metre should be included in the circuit and connected with an audible alarm, so that warning will be immediately given should the current exceed the standard amount.
29. All switches, cut-outs, safety-fuses, resistance-boxes, distributors, regulators and the like, must always be mounted on a non-combustible insulating base, their contact surfaces kept bright and movable parts examined at least once a day.
30. All switches must be quick in action, and arranged to simultaneously make or break at both poles — connections and rubbing contacts are to be preferred.
31. Arc-lamps should never be employed in factories where there is fine dust, as from flour, pulverized cork or similar substances floating in the atmosphere.
32. The frames and other exposed parts of arc-lamps should be properly insulated from the circuit. Each lamp must be provided with a proper hand-switch; and wherever it is possible that an excessive current may be thrown on to any one lamp or series of lamps, automatic shunts or switches must be provided for each lamp to prevent all possibility of the forming of a dangerous arc.
33. Arc-lamps should be provided with means to prevent the carbons from falling out should the clamps fail to hold them.
34. Arc-lamps must have globes closed at the bottom; and wherever they are placed in proximity to any combustible material, like draperies, goods in show-windows, flyings in fabric factories, or in wood-working establishments, they must be provided with very high globes or spark arresters, and the globes be surrounded by wire netting, to prevent the falling of a broken globe. Broken globes must be replaced at once.
35. Incandescent-lamps should in all cases be mounted in sockets which effectually conceal the terminal connections. Safety plugs will not be allowed in lamp-holders.
36. No dynamo or other source of electricity or motor shall be placed in any room of any cotton, woollen, flax, jute or flour mill or similar mill of like description, excepting in the engine-room thereof; and where it is necessary to locate a dynamo or other source of electrical energy or motor in a dangerous position, such generators or motor must in all cases be housed, and special permission must in all such cases first be obtained.
37. Dynamos, generators and motors in all cases should be placed on dry foundation, and preferably raised from the floor by means of insulating skids. They should be kept free from accumulations of oil and dust. A main switch should be placed at or near the dynamo or motor.
38. Dynamo electric-machines should in all cases be provided with an automatic governing device capable of controlling any change in the current.
39. Storage-cells should in all cases be arranged with a space of one-inch between the cells, on insulating supports and in a dry place, a metal tank or tank lined with metal placed under them to catch any leakage. They should be kept free from moisture and dust, and preferably should be enclosed in a box provided with holes for the escape of gas.
40. Fusible safety strips should be located in the leads conveying the charging-current to the storage battery, and in circuit from storage-battery to translating devices. Switches should likewise be placed in both circuits. Magnetic cut-outs may be employed in place of fusible strips.
41. All circuits shall be tested at least twice a day with some approved apparatus designed for that purpose, in order to discover any ground connection or escape that may exist. A record of these tests shall be entered in a book provided for this purpose, and a transcript therefore furnished to the proper authorities once a week.
42. Where secondary generators or transformers are employed, they should preferably be located exterior to the building in a specially-prepared fireproof structure, which should be perfectly dry. Where necessity requires that they be within the building, they should be housed in a dry wooden room lined with asbestos board — a cut-out should be included in the primary circuit, adapted to act at any increase of twenty-five per cent above normal current. A warning or danger sign should be placed upon door of such housing. When electric-light or power circuits are intended to be constructed, full particulars of the proposed installations and all its details must be given in writing to the proper authorities. This must be accompanied by samples of the conductors with a statement of the maximum current which it is designed to send through each. Samples of the cut-outs, switches and fusible plugs should likewise be submitted unless they have previously been approved. The signing of these rules and regulations by any electric-lighting power or other company transmitting electric currents, shall be considered as a guaranty on their part that they will faithfully observe all the conditions, and make such reports as are therein provided.

II. — RULES TO BE OBSERVED IN LOCATING AND CONSTRUCTING ÆRIAL AND UNDERGROUND CONDUCTORS.

1. Conductors conveying currents having an E. M. F. of over fifty volts, where carried through cities or closely-settled localities, should in all cases be insulated.
2. Conducting wires over buildings must be located at least seven feet above the roofs, and also high enough to avoid the ladders of the fire-department.
3. Conductors conveying currents for arc-light or power, secondary distribution or the like, and when run parallel with telegraph or telephonic conductors, should in no case be nearer than ten feet where single, and six feet where double. By double is meant outgoing and return leads.
4. Conducting wires must be secured to insulating fastenings and covered with an insulation which is water-proof on the outside, and not easily worn by abrasion; and where wires are passed through walls, cornices or the like should be protected as in the rule.
5. Conductors carried along the exterior walls of buildings should in all cases be supported upon glass insulators, placed at least ten inches apart and so arranged as to be liable to abrasion from cornices, metallic shutters and the like. Special means should be provided to prevent accumulations of ice upon such conductors.
6. Conducting wires conveying currents, such as employed in electric-lighting and power, and which are in proximity to other wires, should be so secured or guarded as to prevent any possibility of contacts between the wires in case of accidents to the wires or their supports.
7. All conductors carried underground should be encased in lead, and preferably located in conduits made of a material which is non-porous to gas or water, non-inflammable and of good insulating character.

III. — RULES TO BE OBSERVED TO PREVENT ACCIDENTS TO LIFE.

1. No work of any sort, kind or description should be done upon an electric circuit whereon the E. M. F. of the current flowing exceeds fifty volts for alternating currents, and two hundred volts for continuous currents.
2. Where it is necessary to repair any portion of the line or fixtures, or lamps or other translating devices contained therein or thereon, and the current be flowing thereon, such portion of the line or fixture must first be cut out of circuit by means of a suitable cut-out, which shall be in electrical connection with a visual or audible tell-tale device, to show or make evident by sound that no current is flowing on the line.
3. Where bare conductors are employed for the transmission of power, they should rest upon insulating supports, and be provided with an insulating covering for at least two feet each side of the support.
4. Long lines having a number of arc-lights in series should be provided with a shunt and suitable cut-out switch around every five lamps.

MAPLE FLOORING.— "Maple flooring," the New York gentleman remarked, "does not receive the attention in our market that it deserves. The architects are decidedly hard-headed. Of all men they should be progressive and up to the times, but they linger by the way in a provoking manner. They have been used to yellow-pine flooring, and yellow-pine flooring it must be to the end of the law. Now as between the two kinds of flooring, maple and yellow pine, I consider maple much superior in most cases. Especially when trucks are run over the floor, or it is otherwise subject to heavy work, maple leads so far that yellow pine is nowhere. Keep a maple floor damp, and the heavier the business done on it the harder the boards become. The wear there is in it is simply astonishing. The architects, however, seem to care little for that. They go on, on in the same old rut. If the use of maple for flooring were an experiment there might be some excuse for this pig-headedness, but it is no experiment. It has been tried and not found wanting in a single respect." — *Northwestern Lumberman.*

THE FACADE OF THE CATHEDRAL AT FLORENCE.



THE character of the work done at Venice supplies no rule for the judgment of what was to be done at Florence, especially on the Duomo, which, with St. Mark's, must, so far as artistic and historical interests are concerned, be placed in the first places in importance of all Italian churches. The problem in Santa Maria del Fiore has been doubled, involving not merely restoration but completion. The history of the façades of the cathedral has never been thoroughly searched out, and may some day be the subject of an interesting monograph, in which we shall learn to regret the way in which revolutions of taste in Italy abolished the genuine old, to substitute spurious new ideals, and of which we have an indication in a passage of Rondinelli, writing of the Duomo: "There was a façade of Gothic architecture (*Tedesca*) carried up about to the half-way, full of most beautiful niches intended for statues, which later were put in place; some were by the famous Donatello and some by other sculptors, artistically done, with most beautiful orders disposed and divided. There one saw several chapels introduced, divided and sustained by most beautiful and varied columns, some smooth and some twisted, so that, what with the variety of marbles and porphyries and the difference of the statues and columns, it had a very rich appearance and filled with majesty the sight of the beholder."

Then follows a detailed description of what had been done and of the statues of the historical personages introduced, and the opinion as to its general worth that it was equal to its position on the cathedral, but in 1587, being regarded by the classicists of the day as barbarous, it was destroyed, as Rondinelli says, so brutally that "there was no piece of marble that was got out entire; even the columns were broken, which was, in truth, a pitiful spectacle, first in the destruction of the façade, and, secondly, in the breaking of those beautiful marbles and porphyries, worked with so much cunning that if they had been taken out whole they would have served for ornaments in many other places with advantage to the works, which would have been able to sell them for some hundreds of scudi."

What consolation there is in proving that former and presumably more æsthetic generations were really more barbarous and tasteless than this we can here obtain and have the grim satisfaction of uttering maledictions on the Florentines of the end of the sixteenth century, as on the Venetians who, in the beginning of the thirteenth, melted the statues of Lysippus to coin money for their soldiers, and later destroyed the Parthenon car of Minerva; the French, who demolished scores of churches in Venice, and the ecclesiastical authorities who have covered Italian basilicas with the garniture and bad painting of the seventeenth century and whitewashed the frescos of Giotto and his successors for a hundred years or more. There is really no room for outcry if this generation should at most remove the disguisement of time and decay and restore to us the noble works left by great epochs of art in a state approximating to that in which they were completed.

The completion at length of the façade of the Duomo of Florence, which will be unveiled with great ceremony next spring, gives a peculiar appositeness to this and all other questions raised by the process of restoration, because we have here a church constructed by the greatest masters of architecture and sculpture of the Florentine Renaissance, peculiar in style, unique in construction, left to our day wanting its most attractive feature, the front; and this generation has determined that the work left incomplete shall now be completed with the best talent, whatever that may be, which Italy can furnish, and that the problem of how far this new and therefore necessarily crude surface juxtaposed with the old and time-toned, shall be harmonized with this.

It is premature to pronounce judgment on the work of de Fabris, to whom, after an exhaustive competition, the work was assigned in 1867, until it has been exposed entire to the deliberations of taste for a period sufficiently long to secure a firm judgment; but during a brief partial uncovering of the work in progress I was able to see enough of it to venture the opinion that it will be found, as a whole, quite in harmony with the body of the cathedral, and in itself a work which will do honor to the state of the arts in Italy and convince the outside world that that state is nobler than is generally believed. All the most eminent sculptors of Italy have competed for the honor of contributing the statues which fill the niches, the owners of all the quarries whence was taken the stone have offered the marbles needed, and so on with all the material, either gratuitously or at the cost of production, while the purely decorative work has been done by the Tuscan stone-cutters, whose business it is to do this kind of work at wages rarely much exceeding a shilling a day, the funds being furnished by voluntary contributions from the nation and the strangers interested in Florence (in connection with which I may note *en passant* a curious exception to the result of architects' calculations: the original estimate was for 1,500,000 francs, and the work will cost about 1,000,000 francs!)

The concentration on the façade of all the best talent of Italy, aided by the contributions of the entire kingdom, and resulting in a work which is maintained by some of my friends to be really one of the greatest, if not the greatest, of modern works in decorative architecture, gives the new element an importance in the question of harmonizing the parts for which we have no analogical term in the debates on St. Mark's, where no important part was new or merited to weigh *per se* in the balance. The desire of the Florentines to see their Duomo complete, but fresh and new as from the hands of the first builders, glistening like a bride-cake, is comprehensible, for the new as much as the old is their pride, and the general public opinion of the city would, I believe, like to see the surface entirely renewed, so as to be in keeping with the façade. And so far as this architecture pure and simple goes, there is this consideration of great weight urged by Signor del Moro, the architect who has succeeded de Fabris, that the designers of the church made one of the principal features of the design the employment of broad, flat surfaces with the relief and motive of the general decoration given by color, and to this end they employed a ground of white marble relieved with a deep green broken by red. Time and the slow accumulation of incrustations of dust and dirt, with the decomposition of the marble, have degraded the whites to a dingy gray, almost brown, and veiled the dark green to an extent that quite obscures the color, and in many passages it is difficult to see the line of demarcation between them. Under such conditions it is impossible to realize the idea of the designer, who made his decoration depend on colors which are no longer visible. Therefore, says del Moro, we must clean this surface of all the incrustations and deposits and bring out the color of the material, not, indeed, as when it was newly cut, but with that tone alone which age would give it. This idea has prevailed in the restorations, and the whole south flank, from the point where the skinning was stopped several years ago, has been carefully washed with brush and water, all the salient lines and sculptured detail being relieved of the dirt gathered by their projecting surfaces, excepting the gate of the Pisiani, which is reserved for later treatment.— *Letter from Florence to the London Times.*

COMMUNICATIONS

FRENCH ARCHITECTURAL JOURNALS.

ST. LOUIS, MO., January 14, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,— What French journal (architectural) contains the best and most illustrations of French architecture? What is the name of the official organ of the leading French architectural society or association? By giving your opinion on the above questions you will greatly oblige one of your subscribers.

Yours truly, FRED. W. FOLK.

[LA REVUE GENERALE DE L'ARCHITECTURE, a monthly publication, is the best, both in quality and quantity. The best of the weekly journals is *La Construction Moderne*, edited by M. Paul Planat, formerly managing editor of *La Semaine des Constructeurs*, also a most excellent journal. The official publication of the leading French society is the *Bulletin Mensuel de la Société Centrale des Architectes.* — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

THE SOUND TUNNEL BETWEEN DENMARK AND SWEDEN.— Some two or three weeks back it was currently reported that the committee engaged in examining the scheme for a tunnel under the Sound between Denmark and Sweden, had arrived at the decision that they could not recommend it to their respective governments. This, however, is not correct, although possibly one or several members of the committee may have expressed themselves in a way that tended to circulate the above rumor. Under these circumstances a short authentic account of the exact state of affairs may not be without interest. When the representatives of the French company, who are starting the project — Messrs. Deloncle and Rothe — saw this rumor in the Scandinavian newspapers, they first applied to the Danish Government, and later, on the direction of the former, to the Swedish Government for a confirmation or denial of the same. It has now transpired that no definite report had been received by the Government. The gentlemen with whom Messrs. Deloncle and Rothe conferred in Stockholm, and of whom one or two were ministers of state, appeared to take a favorable view of the tunnel project, and as the difficulties were supposed to be more of a financial than of a technical nature, they expressed the desirability of obtaining more exhaustive statistical information as to the traffic, etc This has now been collected, and it appears that the present traffic between Sweden or Denmark, or even the traffic between Malmö and Copenhagen, is sufficient to insure the financial success of the scheme. And there is, of course, no doubt that the present traffic will be very considerably increased should the project become reality. This having been ascertained, the two engineers returned to Copenhagen,

where they have conferred with the Prime Minister as well as the Minister for the Interior, both of whom have expressed themselves in favor of the scheme. The results of the latest negotiations are, that the Danish and Swedish Governments are in favor of the tunnel — if it be realized — being built by a private company, but that the traffic, when it is ready, should be worked and managed by the State railways of the two countries; that they have no objections to the plan itself, nor to the respective governments helping the undertaking with money during the building of the tunnel, and that this should be taken over by the State when finished, provided the necessary Parliamentary sanction be obtained. Steps are now being taken for the immediate working out of more detailed plans, and it is anticipated that these may be forthcoming as early as January next year. As already mentioned no serious technical difficulties are anticipated, and altogether the prospects of the scheme seem to be all the promoters can desire. As to the probable terms of payment, these, of course, entirely depend upon future negotiations, but the French company seem to anticipate a series of payments on account, when portions of the tunnel are completed. The entire working would, of course, be superintended by gentlemen appointed by the respective governments.—*Engineering.*

Mexican Windows. — Mexicans seem to entertain the idea that windows were made to look in at as well as to look out of, and it is a matter of daily occurrence for men, women and children of the *gamin* order, including peddlers and professional beggars, to congregate outside the bars and stand calmly staring in at us by the hour. The first sight of these barred windows strikes the stranger in Mexico rather unpleasantly, and he is apt to fancy himself in prison behind them, with his iron bedstead and brick floor for suitable accessories. In time, however, he realizes not only the conveniences but the necessity of them, and by and by feels an uneasy sense of insecurity if by some rare chance he finds himself not thus protected. The greater portion of Mexico is a land of perpetual summer, where windows must be open both night and day, and these gratings cannot be "picked" like locks, or noiselessly cut like panes of glass. But though one may sleep here in perfect security without closing a shutter, it is well to move one's effects from proximity to the windows — for the *ladrones* have a habit of throwing in ropes with hooks attached and dexterously drawing out even your garments — from which practice, perhaps, originated the Texan slang word "hooking" for stealing. It is only justice to add that there is far less thieving going on in Mexico, in proportion to population, than in our own country, for the influence of Roman Catholicism is paramount, especially among the poorer classes. I venture to assert that with all your spring-bolts and careful precautions to bring in even the door-mats at nightfall there is more stealing done in any northern city in a single day than in all Mexico in a year's time. — *Correspondence Philadelphia Record.*

Collapse of a Turbine Penstock. — Wherever wooden tubes are used for supplying turbine water-wheels, instances of rupture occur by bursting of the tubes by the impact of the suddenly arrested water when the gates of the wheel are closed suddenly. At a paper-mill in New Jersey occurred the unusual accident of the collapsing of an iron penstock tube five feet in diameter, built of five-sixteenths inch boiler iron. This tube was about seventy-five feet long, and descended at an inclination of 45° until it reached the turbine at a depth of fifty-two feet, and then this was followed by a draught-tube eight feet long, reaching below the turbine, making the total fall sixty feet. For a number of years the water had been admitted and closed from the turbine by the gates around the wheel, until, for some repairs, the water was shut from the penstock by the gates at the upper end. As the water sank in the tube there was a vacuum formed in the upper portion exceeding about thirty-three feet above the tail race, and the tube collapsed at once, the iron tearing off some of the riveted seams, and the two sides reaching to within a foot or so from each other. Although this result was quite expected by those in charge of the turbine, the application of Sir William Fairbairn's confessedly approximate rule, gives as a result a collapsing strength of seventeen and one-half pounds to the square inch, with a recommendation of a factor-of-safety of six, which would reduce the safe pressure to say three pounds. In the new penstock which was put in place in the destroyed one, there were three open vertical vent-tubes six inches or more in diameter, for the purpose of preventing a recurrence of the disaster, which was, in the first place, wholly inexcusable in view of the general knowledge, and of the engineering practice on the subject. — *Engineering.*

Popular Notions regarding Steam. — In the *Saturday Post* of October 23, 1886, a Greenock paper, the following appears:

The Pressure of Steam. — "Steam, as compared to water, occupies 1728 times as much space. A cubic inch of water will make 1728 inches of steam at atmospheric pressure. Now, if this steam is compressed into half that space it will give double pressure, or 15 lbs. above the atmosphere; and it will then occupy only 864 cubic inches. If reduced again to half its volume, it will occupy 432 cubic inches, and will give 30 lbs. pressure to the square inch. Reduced again to half the volume, the steam will occupy 216 cubic inches, and will give 60 lbs. pressure to the square inch. We can go on reducing in this way until we find that a cubic inch of water turned into steam, and compressed into a space of 3 cubic inches, will give the enormous pressure of 3840 lbs. to the square inch."

Greenock occupies a high position in regard to the science of steam; it is the birthplace of Watt, and it has turned out a greater horse-power of marine steam-engines than any other town of its size in the world. Notes about steam served out in the Greenock papers on Saturdays for Sunday meditation ought therefore to be worth reading. Let us take the above extract bit by bit. "Steam as compared to water occupies 1728 times as much space." Only at one pressure is this true, and that is not at atmospheric pressure, the relative volume is then, say, 1648. "Compressed into half that space it will give double pressure, or 15 lbs. above the atmosphere." If we could have steam at that pressure, but still at the temperature of "boiling water," 212° Fahrenheit, then might the pressure be as stated, but steam at twice the pressure must be at its own higher temperature, and therefore its volume must be more than "compressed into half that space." "Reduced again to half the volume. . . . 30 lbs. pressure to the square inch." In addition to the temperature objection there is now an atmospheric objection to this statement. Pressures are stated either as above the atmospheric pressure or as including the pressure of the atmosphere, but the writer of the Greenock note seems to have now forgotten the atmosphere altogether. The pressure he has now attained by doubling is 60 lbs. gross, or 45 lbs. above the atmosphere, and not by any way of looking at it can it be 30. The note goes on doubling and doubling in this way, getting 15, 30, 60 x 64 = 3840 lb. per square inch, instead of 15, 45, 105, 120 x 64 = 7665 + 15. As this Greenock note contains quite unconsciously so many common errors its correction may prove useful. — *Engineering.*

TRADE SURVEYS

Some of our most careful building authorities who have recently expressed the opinion that the other side of the industrial activity has been overlooked mean, in a word, this: that the improvement in prices and the prospects for the very general employment of capital and labor during 1887 will stimulate building activity. They manifest their confidence in their opinion by arranging already for large supplies of material of all kinds at current prices. They argue that what has taken place in the iron and steel industries on a large scale will certainly take place in the building trades on a smaller scale, and that the record of 1886 as to building operations will be exceeded in 1887. There are those who take a more gloomy view of building prospects and entertain, no doubt honestly, the opinion that the advance in real estate which seems to be quite general, and the advance in building materials of all kinds, will act as a retarding influence to building enterprises. While it is early in the season to indulge in prognostications it can be said that so far, at least, the course pursued by builders and projectors of large enterprises is in favor of the first class of reasoners. Future probabilities trouble builders and manufacturers very little. They are quietly proceeding upon a safe basis, that is, buying material enough to cover contracts either in hand or contracts which they have every reason for believing will come to them as soon as the proper time arrives. It is true that real estate, both urban and suburban, has advanced, particularly in the Middle and Western States. Advances have been made in certain favorable localities in the South, but as a rule property is still cheap, and this fact accounts for the anxiety of large capitalists to make investments in that section. No doubt a very large amount of money will be invested in localities this year where the spirit of enterprise is expected to sweep like a cyclone in order that the investors may profit by an early advance. It has taken place at Birmingham, Annistown, South Pittsburgh, Chattanooga, Atlanta, and a few other Southern towns, and is expected by the sanguine investors to take place in many other towns this year and next. Away off in Los Angeles, California, and in two or three other towns in that locality, a real-estate boom has set in. The accounts of it have even reached the far East. There are also some localities in Texas, Kansas, and Missouri, where real estate has taken a sudden bound upward, as, for instance, at Kansas City, and Austin, which is serving as a hint to possessors of large blocks of money to transplant it from idleness in Eastern financial centres to Western fields of enterprise. As before observed the basis of this activity is to be found in the extraordinary railroad building. This confidence is gaining ground every week, even in mid-winter, and the formation of syndicates continues to be announced, having for their objective point the purchasing of land either for speculative purposes or for investment in reproductive channels. All of the industries are thriving, and in jobbing circles business has begun to feel the effect of the movement of the army of drummers for the spring trade. Dry-goods manufacturers have proved their wisdom in improving their facilities for production, and within a week a great many concerns throughout the New England States have resumed full time. The output of our textile mills during the first quarter of the year will largely exceed that of the first quarter of last year; how much it would be guesswork to say. The makers of wood-working machinery report continued improvement and better prices than have prevailed. The tool-makers and machine-makers have also good reports to make concerning new orders and spring and summer trade prospects. Locomotive-makers have, or within a week or two will have, closed contracts for somewhere between 800 and 1,000 locomotive engines. The railroad-managers are now engaged in completing their estimates for engines, cars, and material of all kinds, and it is safe to say that during the rest of this month and February a large volume of business will be crowded in upon the makers of railroad supplies and equipments to be furnished between now and July 1. Even with all the activity that has prevailed in the car works throughout the country, the trunk lines especially, and scores of other smaller roads are deficient in rolling stock. The smaller industrial establishments are finding orders crowding in. The improvement in prices is legitimate and conservative. The producers and manufacturers of the country show no desire to crowd prices into the speculative arena. The iron and steel makers are asking higher prices than a week ago, and, as recently stated, business has been checked somewhat though all know that a heavy demand must be shortly provided for and that the high range of prices will hold for an indefinite time to come. The anthracite coal trade has been checked somewhat by a strike which, at present writing, shows very little signs of weakening. The lumber trade is in winter quarters. The boot and shoe manufacturers expect to produce more goods this winter than last, and their travelling agents report bare markets throughout the West. In certain branches of the textile trade as, for instance, in the cashmeres and worsteds, prices will advance from five to ten per cent. These indications of an upward tendency are calculated to increase the feverishness in all markets, but consumers keep this one fact in mind, that the productive capacity is ample, and that it is only a matter of time when the enormous production will overtake demand and create probably a reaction in prices. The failures occurring since the opening of the year are comparatively few in number. The financial condition is strong and an abundance of money is stored in Eastern centres with very little demand from the West. No new questions are arising to disturb the confidence of producers and exchangers in financial, railway, or other problems. The laborers are acting with conservatism and will probably enter upon the new year with understandings which will avoid the recurrence of the strikes which so seriously unsettled confidence in building during the early part of last year.



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HOUSE OF WM. G. SALTONSTALL, ESQ., FAIRFIELD STREET, BOSTON, MASS.

PEABODY & STEARNS, Architects.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI.

No. 579.

JANUARY 29, 1887.

Entered at the Post-Office at Boston as second-class matter.

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DR. WERNER SIEMENS, one of the most distinguished men of science now living, stirred up, a few years ago, a rather lively controversy in the scientific world by a suggestion that it might be possible, after the world's supply of coal and wood had been exhausted, to warm the chilled bodies of the unfortunate men of that period by means of some application of electricity as yet undiscovered; with which he coupled also the idea that it was at least conceivable that similar means might be employed for nourishing the human race after all vestiges of plant life had disappeared from the earth. It is not unlikely that even scientific men are fond of a good dinner now and then, and the idea of feeding on electric currents seems to have been more than they could endure; for Dr. Siemens was attacked with considerable warmth as a visionary, who amused himself with idle fancies instead of scientific reasoning. A few months ago, however, the venerable philosopher took occasion to explain his theory, which, curious as it is, is, as he says, anything but the idle fancy which it was accused of being.

SCIENCE believes, said Dr. Siemens, in the interesting address which we find quoted in the *Schweizerische Bauzeitung*, that all substances have, connected with them, a certain portion of energy, which, like the elements with which it is associated, is indestructible; modifying often its form and relationships, but always traceable and constant throughout its changes. When a substance combines chemically with another, it often happens that the compound substance formed by the combination, by some quality of its constitution which we know nothing of, associates itself with a smaller relative proportion of energy than that proper to the substances of which it is composed; and in the act of combination this surplus of energy, which no longer finds a place in the new substance, is set free, and manifests itself as heat or light. The burning of coal is a familiar example of this. The carbon of a given quantity of coal, and the oxygen with which that quantity of coal will unite, possess more energy than the carbonic acid formed by the union of the two elementary substances; and in that union the excess of energy is disengaged as heat. The same thing takes place when wood or any other substance is burned. Now it is remarkable, that although we can obtain this manifestation of surplus energy, to warm our hands with, by the combination of many of the substances now existing around us, the separation of the compounds, so that we can combine their elements again when we want more heat, is a very different matter, and when all the coal and wood are gone we shall find it very hard to get them back again out of the carbonic acid into which we have resolved them. In fact, there are only two common agencies by which the bond between chemical compounds can be directly dissolved. One of these is light, the decomposing effect of which is as yet not well understood, and the other is electricity, which is now constantly used to effect chemical decomposition in the arts. It is certainly not unreasonable to suppose that we shall some time use it more effectively for this purpose than we now do, and, although the decomposition of carbonic acid, or of water, which is perfectly practicable, would yield rather unmanageable gases, it is, as Dr. Siemens says, quite within the bounds of possibility that the mechanical force derived from wind, or falling water, or waves, converted into electricity by revolving magnets or otherwise, may hereafter be used for producing, by decomposition, potassium, or magnesium, or some other solid, portable, and tolerably effective fuel.

WHILE we could reconcile ourselves, if necessary, to the idea of sitting around a potassium fire on winter evenings, there would be still a considerable step to be taken before reaching the production of food by electricity, and here Dr. Siemens only ventures to indicate rather vaguely the way which he thinks it possible that science might follow. So far as we know, the most essential element of food is nitrogen, which we consume in combination with a great variety of other substances. Now these combinations of nitrogen with other substances are effected in nature mainly by the obscure processes of vegetable life, nitrogen in its natural state having no disposition to combine with other elements, even when aided by heat. By indirect chemical action it is possible to force nitrogen into combination with oxygen, to form nitric acid, and with hydrogen to form ammonia; but neither of these substances are edible, and after all vegetable life had disappeared from the world, we should certainly starve if we had nothing better than such things to depend upon. Here, however, electricity comes to our aid, in a new way. Although one form of electric current, that of low tension, forms the most powerful decomposing agent we know, a current of high tension may be made, either directly or by induction, to exert a powerful combining force. By passing the sparks of an induced current of high tension through air, the condition of the atmospheric oxygen is changed. It becomes ozone, and in that form seizes upon the nitrogen with which it was before only mixed, and combines with it, forming a vapor of nitric acid, which shows itself to our senses, by the "sulphur smell" which follows the sparks of a frictional electrical machine or a Ruhmkorff coil, or a flash of lightning. Whether nitrogen may by similar means be made to unite with carbon, hydrogen and the other elements of organic substances, is for the electrical chemistry of the future to decide; but it cannot be said that it is scientifically impossible.

THE *Wiener Bauindustrie-Zeitung* says that the Egyptian Ministry of Public Works is at present very busy with a scheme proposed by a well-known American gentleman, Mr. Henry Cope Whitehouse, for refilling and putting in order what Mr. Whitehouse believes to be the Lake Mœris of the ancients, a depression situated in the fertile district of the Fayoum, not far from Cairo. The original lake, according to the ancient writers, was an enormous artificial basin, more than four hundred miles in circumference, and three hundred feet deep in some places, which was excavated about 1350 B. C., as a storage reservoir to retain a part of the overflow water of the Nile, with which it was connected by canals. The lake being below the high-water level of the river, the water flowed into it through the season of inundation, and out of it during the low-water season, but the amount of water stored in it was so large that it served not only to supply the plains in the neighborhood, but to increase the flow through the lower Nile itself, until the time of inundation returned. Besides the excavation of the lake, a work in comparison with which the cutting of the Panama Canal is a trifling affair, the Egyptians built various permanent structures in or near it, among which were two pyramids, each six hundred feet high, and crowned by sitting figures, which stood in the middle of the lake, and commemorated its construction. For more than a thousand years this huge piece of engineering fulfilled its purpose admirably, converting the desert region about it into a rich and fertile district, and bringing prosperity to the numerous towns and cities supplied by its waters; but during the dark ages which succeeded the Roman period it was allowed to go to decay, and its site is now only marked by the remains of some of the more important buildings

which stood near it, and by a small natural lake which is considered by some to occupy a different position from that of the ancient excavation.

MR. WHITEHOUSE, who, as we have heard him say, took the novel course for an Egyptologist of going to look at the objects in which he was interested, before beginning to theorize about them, was struck with the appearance of the district in the neighborhood of the ruins of the Labyrinth, and of the scanty traces discovered by Linant Bey of what he considered to be the commemorative pyramids of the lake, and made such observations as he could to determine whether the level of the district, relatively to that of the Nile, was such as to render it possible that it could ever have been overflowed from the river. Nothing is more difficult than to estimate such relative levels without the most perfect instruments, but he thought he could trace something of the ancient engineering, and satisfied himself that it might yet be possible to restore the work of King Mœris to its original usefulness. His early impression, on more mature consideration, seems to have been confirmed, and he has apparently been able to bring the able men who manage public enterprises in Egypt so far over to his views that a party of engineers is to be sent at once to make careful surveys and levels over the whole region.

THERE has been a good deal of talk for some time about the establishment in London of a "United Arts Club," to include architects, artists and others, the members of which should enjoy the privileges and conveniences of ordinary clubs, as well as the society of men of similar tastes and acquirements, and a beginning has been made by the formation of an association, under the presidency of Mr. Edward I'Anson, the President of the Royal Institute of British Architects, which has already engaged temporary quarters at the St. James Place Hotel, in St. James Place, in the middle of the club region of London, and invites gentlemen interested in the scheme to meet and take steps for the permanent establishment of the club. All persons engaged in the study and practice of architecture, the other fine arts, and engineering, are eligible, and it is intended, as soon as circumstances will admit, to buy or build a house which, in addition to the usual reading, dining and conversation rooms, shall contain bedrooms for the accommodation of members not residing in London who may visit the city. This, which is a very popular feature of the Union League Club in New York, would probably be still more popular and useful in a club of architects and engineers, and if the dues of non-resident members are made as moderate as is now intended, the club might easily, we should think, secure a large membership out of the city, among persons of the most desirable sort, who would find their connection with it at times very pleasant and convenient. Of course, only a small proportion of the out-of-town members would ever be in London at the same time, so that a comparatively small club would serve a large number of people of this kind, and experience shows, we think, that a good non-resident connection, which is not much influenced by the shifting fancies prevalent among young men in the city, helps materially in promoting the permanence of such an association. Among the names of the architects interested in the scheme which the *British Architect* gives are those of nearly all the most distinguished men in the profession, and the club certainly ought to be one of the pleasantest and most successful in London. If it should prosper as we hope it will, it is likely that American architects and artists who have the necessary introductions will find as kind a reception in it as it is possible to give, and the courtesy which is so much cultivated between clubs in good standing is likely to be conspicuously shown where artists, architects and engineers are concerned. Curiously enough, the most distinguished and exclusive club in this country, and the most successful, judging from the eagerness with which membership in it is sought, the famous Century of New York, has always contained a very large proportion of artists and architects, and there are several other well-known clubs in other cities which show by their membership lists that these two professions seem to fit their votaries in a remarkable degree for club life. Whether this is creditable to them or not we will not here inquire, but the fact seems plain that men of the imaginative turn of mind which all artists have in some degree, and which engineers share with them to a greater extent than is generally supposed, enjoy congenial society more than most other people do, and this makes them agreeable and amiable members of social associations.

THE *Architect* quotes from C. Waterton a suggestion about dry-rot which is worth remembering. According to Mr. Waterton's definition, dry-rot is the "decomposition of wood by its own internal juices, which have become vitiated for want of a free circulation of air." We should rather say that the vitiation or fermentation of the confined juices prepared the conditions for the development of the dry-rot fungus communicated from without, but this may, perhaps, be considered the same thing. Whether the effect of the corruption of the sap is direct or indirect, it seems to be becoming every day more certain that a free circulation of air is the best preventive and remedy against the dry-rot infection. Mr. Waterton gives some striking illustrations of this from his own experience. After remarking that in nine cases out of ten wood is painted too soon, and that dry-rot is liable to occur from the interruption, in this way, of the access of air to the sap-tubes, he says that he had occasion to alter a house, and put down a new baseboard, of apparently well-seasoned pine, to match the old work, and had it immediately painted. The base was set on the inside of a stone wall, which was, however, furred with studding and laths, and plastered down to the floor. The pine baseboard, enclosed between the plastering on one side and the coat of paint on the other, soon began to be affected. Four months after it was put down, a yellow fungoid growth began to appear from beneath it, and on taking it up, not only the baseboards, but the laths and the lower ends of the furring studs, were found to be completely rotten, a portion showing the characteristic phenomena of dry-rot, while the rest was somewhat moist and covered with the mushroom-like growths of the fungus. A new plinth was then put down, having holes bored through it, three feet apart. This, after many years, remained perfectly sound.

TO test in another way the effect of a circulation of air in preventing the attack of the disease, Mr. Waterton procured some new larch poles. Half of these were set up against the wall inside an unused barn, while the rest were simply set up on the outside of the same barn, leaning against the wall, with their feet on the ground. Within a year, the poles inside the building were attacked with dry-rot, and were used for fire-wood, while those outside, although resting at one end on the damp earth, never showed any signs of decay, and were only removed after they had become thoroughly seasoned and secure against any bad effects from decomposition of their sap. The question here involved, of the influence of a still, slowly-changing atmosphere, even in a room of considerable capacity, in favoring the growth of dry-rot, has, we think, hardly received the attention that it deserves. The numerous cases in which floors over unventilated cellars have rotted and fallen in are, we are convinced, too often attributed to the dampness of the cellar, instead of the stagnation of the air in it. We remember a somewhat striking instance in illustration of this, where, in the garret of an old building, a shore had been set up to sustain the middle of a principal rafter, which had split in seasoning, and was bending under its load. The shore rested at the lower end on a sole of timber, about six inches square, and at the other end was wedged under the principal. None of the timbers were painted, and the garret, though unventilated except by the percolation of air between the slates and boarding, was as dry as any room could well be; yet the sole timber was so rotten that it could be broken to pieces with the hand, and the shore was approaching the same condition. The roof-timbers, which were of pine, and had probably been in place a hundred years, were in excellent condition, and the explanation of the decay of the newer pieces seems to have been that when the shore was set up, with both ends wedged against other timbers, thus closing the ends of the sap-tubes, evaporation, in that still atmosphere, could not take place rapidly enough laterally, through the walls of the tubes, to prevent the fermentation of the juices; and after this had once begun, the same circumstances favored the germination of dry-rot spores, which are probably always present in the air, in the decomposing matter, and the development and propagation of the disease so long as it could find material to nourish it. It is well known that rot almost always shows itself in a favorable atmosphere, where the end grain of one timber abuts against the side of another, and Mr. Waterton's explanation of this, that the closing of the tubes checks the evaporation of the sap in a dangerous degree, is probably the correct one; and it is quite possible that if the shore in the college garret had had two or three auger-holes bored in each end, to expose a part of the pores, the slow movement of the air about it might have been sufficient to save it from destruction.

JOINTS IN WOODWORK.



CAST-COPPER LECTERN. XV CENTURY.

IT would be an indubitable advantage in the construction of our buildings, if framers and carpenters more generally understood the principles which govern the form of joints in woodwork. Many of the most important joints are commonly executed in a manner which is bad in workmanship and improper in form, and to prove the truth of this it will only be necessary to examine any of the less important of our buildings.

Professor Rankine, in his "*Civil Engineering*," and Tredgold, in his "*Carpentry*," have dealt with the subject of joints in a very comprehensive and thorough manner. The forms for various joints recommended by these authors are substantially the same, and are, to a considerable extent, followed in Europe. Here in America, joints in woodwork are generally executed in a much more crude and imperfect manner, even in the best work, where the form is as a rule simpler and less perfect.

The reason for this is not far to seek. In any country like this, where wood is abundant and labor expensive, the system of construction will be different from that used in countries where labor is comparatively cheap and timber dear. The effect will be to simplify the construction to a considerable extent, and to save labor in the execution so far as possible, even at the sacrifice of material.

These conditions have had a considerable influence on the general forms of joints, with the result of producing a quantity of bad work. The question of the adoption of any particular form of wooden structure, which requires the use of more or less timber with a corresponding loss or gain in the labor required upon it will be simply determined by the local cost of labor and materials, and the comparative loss or gain in the two items; but with joints the matter is different.

The strength of any structure must be as the strength of its weakest part, and in most wooden structures the joints necessarily form the weakest portions, so that if the strength of the joints is lessened by imperfect workmanship or improper form, the strength of the whole structure is thereby lessened in a corresponding degree. This has the effect of not only lowering the strength beyond safe limits, but of directly causing the absolute waste of a considerable quantity of material. For example: the members of an ordinary roof of some magnitude are usually much stronger than is actually required under normal conditions, the object being to provide for the effect of the pressure of high winds and for other emergencies which may arise. Some idea of the extent to which this is done may be obtained from the fact that, while it is usual to allow only 8 cwt. per square for the weight of slates and timbers, and much less for shingles and felting, as much as 36 cwt. per square is allowed as the probable wind pressure on the roof in times of gales and hurricanes.

Such emergencies are provided for by the use of timbers of sufficient size to resist such force, should it be applied. But if, in joining these timbers together, the connections are badly, carelessly or improperly formed, the full strength of the timbers can never come into play at all, for if a very high wind take place, the joints will fail under the exertion of a force much less than the roof would safely carry with such timbers properly jointed.

In determining the form of a joint, it should be striven to produce a strength as near to that of the solid piece as is practicable. Rankine, in his work before referred to, lays down a number of rules upon which the form of a joint depends, and the reader interested in the subject will do well to refer thereto. For our present purpose we can consider that the following points chiefly determine such form: (1) The direction of the load; (2) the description of the load; and (3) the nature of the materials to be joined.

As characteristic examples we will consider two cases. In the first place, the joint used in connecting a collar to the rafter in a collar-beam roof. The description of strain here is important, as strictly determining the form of joint. Occasionally a carpenter is found who is under the impression that as the effect of the weight on the roof is to cause the rafters to sag to some extent, the collar must be subjected to a direct compressive strain, and that the best joint is a butting one, as shown in Figure 1. This is altogether wrong. The only possible condition under which the collar could be compressed is where the feet of the rafters are immovable, and even then (a condition impossible to produce in practice) the sagging, and consequently the pressure upon the collar, could not be more than would result from the very slight lengthening of the timber due to the elasticity of the material.

The strain to which any member of a roof truss or other simple structure is subjected may always be found by determining the manner in which such structure, if overloaded, would fail. Thus in the present case the effect of an overload would be to throw the rafters out, as shown by dotted lines in the case of a single pair of rafters in Figure 2. The effect of a load, even that of the weight of the timber composing the roof, would be to *tend* to throw out the rafters in the same direction. The object of the collar, then, is to simply tie the two rafters together, and prevent them spreading out, and the collar is therefore clearly subjected to a tensile or pulling strain.

It is apparent that, such being the strain, the butting form of joint before referred to and shown in Figure 1 would be almost useless, and would in fact depend for its strength entirely upon the adhesion of the nails joining the two parts. Nevertheless, partly from ignorance, this joint is used, and very frequently, even where the strain is understood, to save labor the collar is simply nailed upon the side of the beams.

The proper form of this joint is that shown in Figure 3, in which a portion, usually about one-third of the depth, is cut away and the collar halved on and pinned in place. The inclined edge *a* prevents the piece from being withdrawn, and hence effectually resists the strain. Sometimes this joint is formed by fitting the collar on the rafter with a tenon, and connecting it with an iron strap, as shown in Figure 4; but this construction is only employed in roofs of large span.

The form of joint, if such it can be called, shown in Figure 1, although not infrequent, is a fair example of the manner in which timber may be wasted by bad construction, for the sake of saving a little labor. Can it be doubted that this is very far from true economy?

As an example of strains unlike those just referred to, we will take the case of the joint between the foot of the principal rafter and tie-beam of a king-post roof truss. There is the same tendency here for the rafters to separate as in the preceding case, and the effect is to throw the tie-beam strongly into tension, and the strain on the joint will be a compressive one. The load being communicated to the tie-beam by the rafter at an acute angle, a special provision is necessary in forming the joint. The most important point is to form the butting surfaces at right angles to the thrust, and this is provided for by letting the rafter into the tie-beam, as shown in Figure 6. Then, as there is some tendency for the rafter to slip out of its place, a tenon is provided, forming the joint usually termed the shouldered tenon, as shown in Figure 5. There is a tendency, too, for the rafter to rise

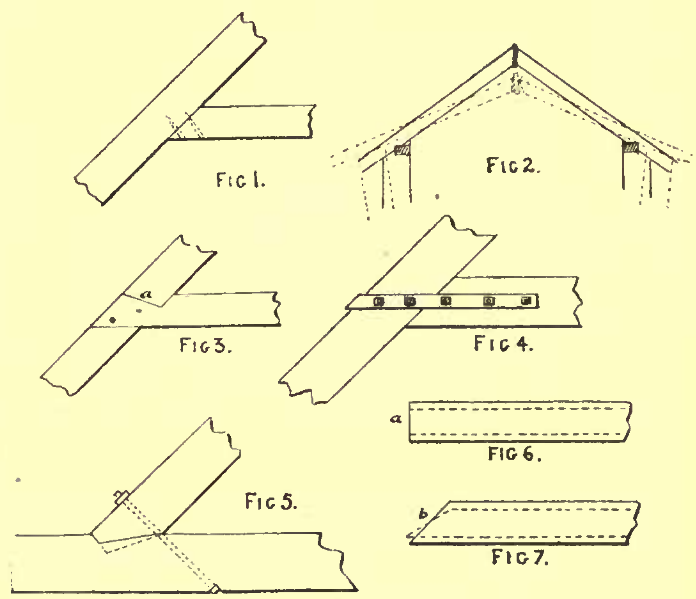


FIG 1. FIG 2. FIG 3. FIG 4. FIG 6. FIG 5. FIG 7.

out of its place, and, to prevent this, a bolt is passed through the two, or in large trusses an iron strap is placed around, to embrace the two and keep them from separating. Other forms of this joint are sometimes employed, some having two tenons and others two bearing surfaces, but their use is limited. It is not necessary to illustrate here, the various bad and ill-considered forms of this joint in common use. The example in Figure 5 is the simplest form which should be allowed, even in unimportant work.

In the proper construction of this joint, it is obviously important to place the end of the rafter far enough back from the end of the tie-beam to prevent detrusion or splitting off of the wood. Hurst gives the following rule for finding the distance. Let *a c* equal the required distance in inches; *B* equal breadth of tie-beam in inches; *H* equal horizontal thrust in pounds, and *S* the cohesive strength of a square inch of the material.

Then $A.\ C. = \frac{4H}{BS}$.

The time occupied in the execution of this joint is, of course, somewhat long, but it is of so much importance (for the whole stability of the roof depends upon it) that the inferior forms so often seen, some without tenons at all, others without straps, would never be adopted by a good workman.

A consideration of the nature of the material to be jointed is of importance in determining the description of joint to be used. The most important characteristic, so far as the question of joints is concerned, is the manner in which it shrinks. It may be taken as a fact that any alteration in the length of a piece of timber by shrinkage is inappreciable, but the shrinkage in the direction of its width is considerable. This fact will have an important bearing on the form

and execution of joints. If a piece of timber be cut off at the end at right angles, it will, on shrinking, still retain the same shape. If the end be cut at an angle, the effect of shrinkage will be to make the angle more acute. In other words, let the full lines in Figures 7 and 8 represent pieces of timber cut at right angles and obliquely, respectively, as shown. When the timber shrinks to the position shown by dotted lines, the end *a* will be unaltered in shape, but still retain its end perpendicular with the body; while the end *b*, shrinking in the same manner, will be altered, becoming more acute, as shown by dotted lines in the figure. Framers should remember these facts, and make allowances for the alteration in shape, and especially when working upon timber unusually sappy.

When a joint is not quite true, it is usual to run a saw-cut between the abutments, to produce a better bearing, but as timber all shrinks to some extent, it is well not to make the abutments fit too closely at first, provided always that the inequality is properly allowed to be compensated by the subsequent alteration in form which will take place from the shrinkage, as explained. ARTUS.

BOOKS AND PAPERS.

HAD Palissy[1] lived in the nineteenth century he would undoubtedly have been set down as a crank, and a most persistent one at that, for he was a man of one idea, spending fifteen years in hard, unremitting toil in search of something which brought him only ridicule, and, after all, was but in part a new discovery, having been known and made use of a generation earlier in Italy. He was not a genius, perhaps, but he had the willingness for hard work, which was worth more to him; and the amount of enthusiasm he brought to bear on his ideas, not spasmodically or on special occasions, but steadily and persistently during all his discouraging career, shows how terribly he was in earnest over his rusty pots and blackened earthenware. A complete history of his life has never been written, for almost the only records we have of him are contained in his own scanty writings, and he was always so wrapped up in his precious enamels that he quite forgot to say anything about himself except as a crank to the revolving wheel of invention. We know that he died in prison in 1590, at the age of eighty, and that he was a native of Saintonge in Brittany, as bigoted and immovable in his faith as a Huguenot as he was in his art. In 1652 he nearly lost his life through his zeal for his religion, being only saved by the interposition of Catherine de Medici, who brevetted him with the doubtful title of "*Inventeur des rustiques figulines du Roy.*" By his own admission he was a person of lowly birth, poor, ill-educated, devoured by misery in his home, where he had naught but a scolding wife and a numerous brood of hungry children, and wracked by the passion for his art in his workshop, where year after year the only results of his labor would be a heap of broken, discolored earthenware. His whole being was absorbed into one idea — to produce a white, glazed enamel on earthenware. What started him in such a direction we know not. Perhaps it was the sight of a Chinese vase in some of the collections at Fontainbleau where he might have been called in his earlier capacity of ambulating artist-decorator. Had he been a person of means he would have gone to Florence and endeavored to learn the secret of the white enamel from the Della Robbias, but as it was he had to begin at the very beginning of everything, examining earths, rocks, chemicals and combinations, ignorant of how to fire his pottery, even to build his furnace, and yet in it all showing a keenness of judgment and an unwavering pursuance of his idea which could not fail to ultimately bring him success. The story of his trials sounds like the fable of the industrious ant. He was years in learning that different enamels fuse at different temperatures, and years more in producing modified mixtures of equal fusibility. He sent his pottery to a factory to be burned and every piece was destroyed. He tried to burn them himself and his oven was destroyed. He thought his furnace finally in proper order, and, for lack of money to buy fuel, he was obliged to burn up his garden fences, his floor, and even the tables and chairs in his poor house. But his furnace failed, and though the glaze on his pots was such as to delight his heart, each piece was stuck over with bits of his furnace lining which had gone to pieces in the heat; and, as he says himself: "*Je mys en pièces entierement le total de la ditte fournée, et me couchay de mélancolie non sans cause, car je n'avois plus de moyen de subvenir à ma famille.*" So many things which seem simple to us now were so dark and confused to him then. We know little of Palissy's successes. His narrative deals only with his failures, and though he tells us exactly how he fell short and what he was striving to do, he carefully refrains from telling how he succeeded, or from what his white enamel was finally obtained, as though he feared some one would rob him of the hard-earned fruit of his years of toil.

The Palissy ware, with its linings of ugly toads and fishes and loathsome reptiles, is too well known to all art amateurs to require any description. Palissy considered white enamel as a basis for all colors, and though white really appears but little in his ware, it was the object of his most cherished hopes. His figures were all taken from living models, if we may believe a contemporary writer, the snakes, fish, leaves and fruit being arranged on a brass dish and secured in place until a plate-mould could be cast over them. They are never beautiful in themselves, but when considered as the evolution of a single man who was obliged to invent everything connected with the process of their manufacture, they possess a priceless value, which is the greater from the rarity of authenticated examples.

M. Burty's biography is not easy to read, being tedious in its statements and unnecessarily confused in arrangement of the subject matter, but it is accompanied by a number of excellent engravings of the best of Palissy's works, which go far to make up for any looseness of literary style.

A FEW days ago, in passing through Essex Street, Boston, we missed an old landmark, an old wooden dwelling-house, with indications in cornice, door and window, that in times past gentler-mannered inhabitants than the denizens of the "South Cove" had sheltered within. Standing just where it would have been swept away by the great fire of 1872, were it not for that curious habit which great conflagrations have of making most rapid progress by eating their way against the wind, it is now replaced by one of the most commonplace of the new business structures which are nowadays forming a group of the finest mercantile buildings in the city, where only a few years ago was one of the most squalid quarters of the town, and a very few years before that one of the quiet nooks where not a few aristocratic families of conservative tendencies preferred to live, rather than migrate to those new-made lands in the Back Bay district. Where the shore-line ran when this old house was built, in 1734, we do not know, but it could not have been far from this place, and it was presumably a pleasant dwelling for the so-styled Captain Child, who, though only a distiller and sugar-baker — whose still, within a year or two, if it does not even now, sent forth an odor at times which warmed the heart's cockles of him who does not abhor New England rum — was yet the grandfather of Lieutenant-General Sir Roger Sheaffe, Bart. It may have been prophetic instinct that caused the artist to make the closing illustration of the book[2] before us a view of this old house in its last estate — a junk shop.

This book shows that for him who cares for such things, and knows where to look, there are old buildings in Boston which have real historical, much picturesque and some architectural value still left, and the fate of the Sheaffe house and the transformation of the quarter where it stood — whose fate suggests that society, like crops, has a rotatory movement — shows that capital will not much longer allow them to remain the home of the foreign proletariat.

The North End, the original Boston, is still largely covered with low wooden structures, inhabited once by men who made the history of Boston, but now the homes of the Hebrew, the Portuguese, the Italian and the Irish, who, not having any cause for venerating the homes in which chance has housed them, have maltreated them, and though by so doing they have aided age in producing a picturesque air of decay, have also hastened the time when they must all become things of the past, concerning whose identity and appearance the curious student must seek for information on the library shelves, where he will find not the least useful and reliable information in the faithful delineations which this book will lay before him. Boston i far from being commercially a dead city, and the water-front now being fully occupied with warehouses, it will not be long before an inner ring of similar structures will be built, which from the formation of the shore-line at the North End will absorb the greater part of the space now occupied by dwellings, and the inhabitants, both the old ones and they who belong to the great unwashed, must "move on." When that time comes, we trust that in the new buildings will be incorporated, after a fashion that has obtained to a considerable degree in Boston, whatever in the way of relics the demolition of old historical buildings may yield, and so unite the new buildings with the old ones, as do with the buildings of which they now form a part, the "Boston Stone" in Marshall's Lane, the "Painters' Arms" on Hanover Street, the "Green Dragon" on Union Street, the "Wadsworth Tablet" on North Street, the "Bell in Hand" on Williams Court, and other fragments, which clearly are of use to succeeding generations, as they are by them put on inquiry, and are brought face to face with incidents and personalities which it is not well that the youth of Boston should ever forget.

A book that is made because the book-maker is in love with his subject, and not because he sees in its making a possibility of making a profit, is more often a book well made and worth making than one over whose inception and development the shades of Pluto have hovered. In this case the illustrator, whose careful work is deserving of much praise, was the originator of the book, and his starting-point, we believe, was a series of sketches prepared some years ago for publication in this journal, but which a fortunate delay on our part enabled him to withdraw when he had become more fully informed as to how much material of the kind a little careful research would enable him to gather together. But illustrations, fascinating as they may be, do but superficially tell a story, and the local coloring is more of this day than of the past. Words are needed to fill out the picture and restore to the mind's eye what the eye itself cannot

[1] "*Les Artistes Célèbres, Bernard Palissy,*" par Phillippe Burty, Inspecteur des Beaux Arts. Paris: Libraire de l'Art. J. Rouam, Editeur.

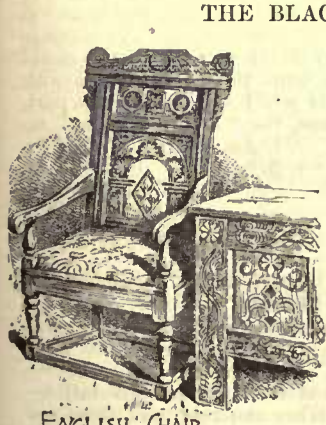
[2] "*Rambles in Old Boston, New England.*" By the Reverend Edward G. Porter. Illustrated by George R. Tolman. Boston: Cupples, Upham & Co., 1887. 439 pp. 93 illustrations.

perceive. For this is needed the aid of some one who can not only write in an agreeable style, but who has been possessed by the zeal of the historical student long enough to be thoroughly familiar with his subject, and so be able to approach it from a personal standpoint and give his work the vitality which is too often lacking in such books. In a very marked measure Mr. Porter has succeeded in making his work readable and interesting, when taken in detachments — as it may well be, since little attempt has been made to weave the disjointed fragments into a connected picture of life in Boston a century or two ago. In a certain way this would have been impossible, but it seems to us that Mr. Porter went astray in not furnishing an introductory chapter, which, by rehearsing the story of the social habits of the citizens in the last century, should put the reader into the properly receptive humor to thoroughly appreciate the bearings of such facts and legends as are recounted in connection with the brief descriptive histories of the several buildings illustrated.

WE have seldom read a preface that was so well worth reading as this short page with which Mr. Bruce Price introduces to the observer — not to the reader, for there is nothing else to read save a specification — the full and interesting series of plates which illustrate the building of a large house at San Mateo, California, a house, by the by, which was illustrated in this journal a few weeks ago. In a few words he shows more clearly where lie the germs of an American style — well-grown ones, too, and far past the dicotyledonous stage — than many a lecturer and essay-writer has succeeded in doing after much more laborious effort. Mr. Price's feeling seems to be that, as everybody has to have a home, it is in the houses that are built and not in the churches, schools, stores, or other buildings that the style must develop, and he holds that the American "cottage" is already *sui generis*, and we incline to agree with him. To be sure, as he says, many of these cottages would be styled in England mansions, in France châteaux, and in Italy villas, but with us they are only cottages and their fashionable inhabitants are still cottagers, so-called. But the type, the germ from which they developed, is the story-and-a-half cottage which can be seen in the older settled parts of the country in the course of any day's drive, and when seen is sure to call from the feminine members of the party encomiums on its snug cosiness and restful homelike air. Little enough of rest some of its earlier imitators had, but fortunately architects have learned their lesson and now simplify their groupings and details much more than formerly. The prevailing fashion of building country-houses has given them opportunity of repeating their experiments, and, as repetition implies increasing familiarity with the requirements and possibilities of the problem it has enabled them to forget tradition and put more intelligent individualism into their work, and so fashion the work that it adapts itself more closely to the real needs of American habits of life and climate than could any anterior or foreign style, however good in itself and in its own proper place.

The book,[1] which contains some two dozen folio plates, is the first of a series on "Modern Architectural Practice," and is much more likely to be of service to architects than the similar publications which this publisher has put forth in the last few years, which, excellent as they are and vastly superior to the works published by the same house a dozen years ago, are more likely to be purchased by the man who proposes to build without an architect's aid than by the architect himself; but as books are made to sell and as architects are a small body when compared with the rest of the world, this is probably just what the publisher likes. The book is made up in an exceedingly attractive style.

THE BLACK-PROCESS.



ENGLISH CHAIR.
FROM THE MONITEUR DES ARCHITECTES.

A BLACK-process, which will compete for favor with the well-known blue-process familiar to engineers and others, is given in the *Photocopie* of Mr. A. Fisch. The process is technically known as heliography, is simple, easy, and inexpensive, while the prints are ink-black, and are made from drawings or positives and negatives. We owe this process to Mr. Poitevin, but it has been slightly improved.

Sensitizing Solution. — Dissolve separately.

1. Gum arabic,		13 drams.
Water,	17 oz.	
2. Tartaric acid,		13 drams.
Water,	6 oz.	6 drams.
3. Persulphite of iron,		8 drams.
Water,	6 oz.	6 drams.

The third solution is poured into the second, well agitated, and then these two solutions united are added to the first, continually stirring. When the mixture is complete, add slowly, still stirring, 100cc. (3 fl. oz. 3 drams) of liquid acid perchloride of iron at 45° Beaumé. Filter into a bottle and keep away from the light. It keeps well for a very long time.

Sensitizing the Paper. — Here especially it becomes necessary to select a paper that is very strong, well sized, and as little porous as possible. By means of a large brush or sponge apply the sensitizing liquid very equally in very thin and smooth coats; then dry as rapidly as possible with heat, without exceeding, however, a temperature of 55° C. (131° F.). The paper should dry in obscurity, and be kept away from light and dampness; notwithstanding all these precautions, it does not keep well long, and if it is desired to act with some certainty, it is better to have a stock to last only a fortnight. Freshly prepared, it is better than a few days afterwards. It should be of a yellow color.

Printing.—The tracing, made with very black ink, is placed in the printing-frame, the drawing in direct contact with the plate; then place over it the sensitized paper, the prepared side in contact with the back of the tracing. There is no necessity to make use of photometric bands, as the progress of insolation is sufficiently seen on the sensitized paper during the exposure. From yellow that it was, it should become perfectly white in the clear portions; that is to say, upon which there is no drawing of the transfer or positive cliché that is to be copied. This is ascertained by raising, from time to time, the shutter of the frame. The exposure lasts from ten to twelve minutes in the sun; in summer less, in winter more. When the exposure is ended, remove the print from the frame, and it should show a yellow drawing upon a white ground. If in the sensitizing bath a few cubic centimetres of a rather highly concentrated solution of sulphocyanide of potassium have been added, this bath becomes blood red, and colors the paper the same; in this case the print also whitens during exposure, but then the image, instead of being yellow, is red, on a white ground. This substance, however, is, if we may so speak, inert, or without any other action; it is very fugitive, and even disappears in a short time in obscurity; it has no other use, therefore, than to render the drawing or the image more visible after exposure.

Developing the Prints. — When the print has been sufficiently exposed, it is taken from the pressure-frame and floated for a minute in the following solution, so that the side upon which is the image should alone be in contact with the surface of the liquid, avoiding air-bubbles between the two surfaces. Otherwise defects would be found in the print. To ascertain this, raise in succession the four corners. The developing-bath is composed as follows: —

Gallic acid (or tannin)	31–46 grains.
Oxalic acid,	1½ grains.
Water,	34 oz.

In this bath the orange, yellow or red lines are changed into gallate or tannate of iron, and form, consequently, a veritable black writing-ink, as permanent as it. The print is then plunged into ordinary water, well rinsed, dried, and the print is now finished. The violet-black lines become darker in drying, but unfortunately the ground, which appears of a pure white, often acquires, in drying, a light violet tint. For prints with half-tones, this is of no importance; but for the reproduction of plans, for example, it is very objectionable. By this process we have the satisfaction of obtaining a drawing in black lines similar to the original, and in most cases this is sufficient.—*Engineering News.*



[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE OF WM. G. SALTONSTALL, ESQ., FAIRFIELD STREET, BOSTON, MASS. MESSRS. PEABODY & STEARNS, ARCHITECTS, BOSTON, MASS.

[Gelatine Print, issued only with the Gelatine and Imperial Editions.]

FISHERMEN'S HOUSES, CAPE ANN, AFTER AN ETCHING BY STEPHEN PARRISH.

MR. PARRISH, one of the best etchers of the day, was born in Philadelphia, in 1846. He began to use the etching needle in 1879, his interest in the art having been aroused by some plates of Appian's. His earlier subjects were taken from scenes on the Schroon and Delaware Rivers, and in Pennsylvania and New Jersey. Then his fancies travelled farther north, and he produced a number of plates drawn from the Cape Ann fishing-towns — Gloucester, Annisquam, and Marblehead — and later found congenial themes on the New Brunswick and Nova Scotian coasts. Though Mr. Parrish has executed a number of etchings, wherein the beauties of a country landscape are well portrayed, his greatest successes have been won with pictures of harbor and shore; and he is never, to our mind, at his best away from the smell of salt water. In 1884, there was privately printed a "Catalogue of Etchings by Stephen Parrish, 1879–1883," which contained a descriptive list of all his etchings made during that time, some eighty in number. Since then Mr. Parrish has travelled in Europe, and etched a number of plates in Normandy, Spain, and England, among which we may specially mention his views of "Greenwich" and "London Bridge." Other important plates, some

[1] "*Modern Architectural Practice, No.* 1." A large country-house. By Bruce Price, architect, New York. William T. Comstock, publisher. Price $5.00.

of which are very large, are "November," "Old Fish-House," "The Shepherd's Christmas Eve," "Low Tide, Bay of Fundy," "Portland, N. B.," "Coast of New Brunswick," and "Midsummer Twilight," and reproductions of the late W. M. Hunt's "Gloucester Harbor," and W. H. Brown's "Venice — Morning of the Carnival." His last plate, entitled "A Gloucester Wharf," is in dry-point, and, although the first which Mr. Parrish has made in that medium, is a most successful one.

We are indebted to Messrs. Frederick Keppel & Co., the well-known New York print-sellers, for permission to reproduce Mr. Parrish's etching.

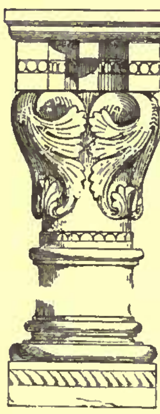
CHURCH OF NOTRE DAME DE L' EPINE, NEAR CHALONS SUR MARNE, FRANCE.

The appearance of this print in the *Moniteur des Architectes* enables us to republish it and so add to the information which, in such meagre measure, we were able to furnish a correspondent who, some months ago, asked us for particulars about it.

COMPETITIVE DESIGN FOR THE ALGONQUIN CLUB-HOUSE, BOSTON, MASS. MR. CARL FEHMER, ARCHITECT, BOSTON, MASS.

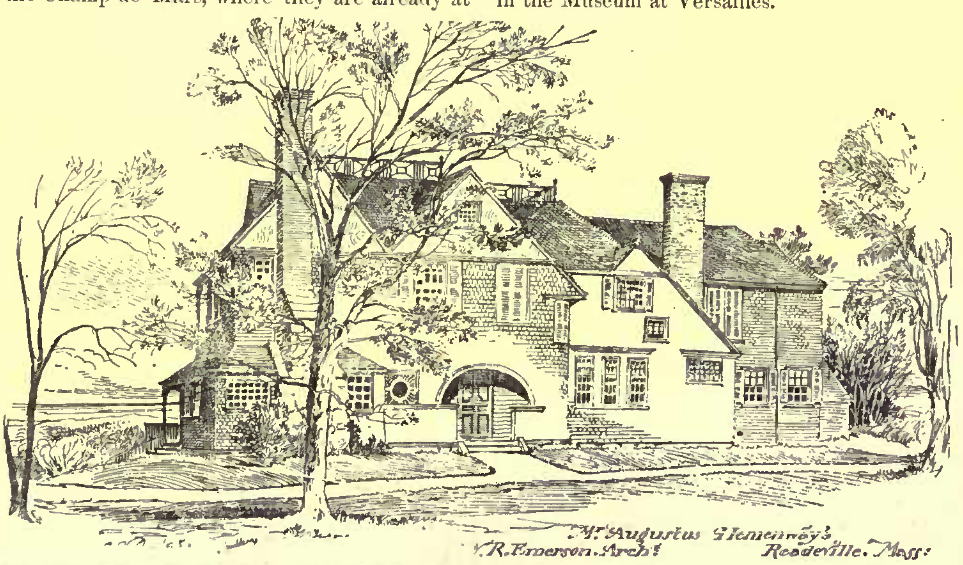
ACADEMY OF MUSIC, MACON, GA. MR. ALEXANDER BLAIR, ARCHITECT, MACON, GA.

PARIS GOSSIP.



RECENTLY one of my friends suggested the possibility that the door of this journal might be open to me. Howsoever slight an opening you are willing to make for me, allow me to try and slip through, and permit me to address to you this courier of Paris, for which I beseech your indulgence.

I must, then, speak to you of Paris, and unfortunately, this subject is extremely unpromising at this moment. All Paris is just coming back from the baths, the sea, and the country. The vacations are hardly finished, and we have only had time to unveil some statues, among others that of Berlioz in the Square Ventimille, the work of the sculptor, Alfred Lenoir. All this is sufficiently stale. Nevertheless, a great deal of noise is made at the moment, and people are agitating themselves extremely on the subject of the Metropolitan Railroad and the Exhibition. This last enterprise is entering on the period of execution, and workmen have taken possession of the Champ de Mars, where they are already at work on the excavations and terracing. There is much discussion also over the Eiffel tower. There is a general feeling of disquietude as to the effect of this gigantic tower — too gigantic when compared with the rest of the structures. For my own part I fear that the result will be far from satisfactory from the point of view of art. Nevertheless, I sincerely wish to find myself deceived, since, in the eyes of certain people, the success of the exhibition of 1889 seems to roost at the top of this iron tower, three hundred metres in height.



As to the Metropolitan Railroad, I wait the publication of the exact route it is to traverse before speaking about it. What this route will be it is not yet definitely determined. It will be partly subterranean and partly elevated, but which part will be below ground and which above is still under discussion.

That which is always interesting at this season at Paris is the annual exhibition of arts as applied to industry, interesting particularly for us architects, who can take note of the progress, the improvements and the discoveries of everything which, from far and near, has a bearing on architecture — furniture, ceramic products, lighting, heating, ventilation, etc. Everything that serves our need and our comfort is there; but how many steps still remain to be taken in this path, and what advances still remain to be realized! One feels everywhere a great desire to make comfort perfect, but I think that we are still far from perfection, and in expressing this opinion I do not speak only of the comfort which can always be procured by the wealthy, but of that practical and not luxurious comfort which ought to belong to all and in a general way serve our everyday needs. Take, for example, a matter with which people have concerned themselves for some years to such a degree that all our walls are covered with placards advertising continually the last invention of the kind. I speak of heating. It must be confessed that we don't know how to warm ourselves. We know how to burn wood or coke in the fireplace. This warms one room. We pass into another and we freeze. In winter our apartments are like Scotch douches, where one is played upon by a warm jet and alternately with a cold one. We have not yet found a practical means of warming the whole house by means of a furnace, a thing which will be ultimately accomplished, I hope. We see on all sides, rolled in on wheels, movable stoves and fireplaces, which do not warm us badly but asphyxiate us far more successfully, and every day we see spring up a new and "perfect" system, "absolutely safe," which proves that the system which was last discovered was worth absolutely nothing — a fact which would seem to prove that systems in general are n't worth much of anything. Ah! when shall we see heaters capable of warming our house from top to bottom and spreading through all the rooms a uniform warmth? Here is something, I believe, which would satisfy everybody, and the proof of it lies in the relative success of all of these stoves on wheels, whose only merit is that they can be moved from one room to another. In this way they succeed in bringing it about that we do not have too great variations of temperature in the same room. But how far from practical is all this!

At this time there is a very fair exhibition of stained glass at Champaigneulle. I will mention among others a fragment of a superb window intended for the Cathedral at Metz, of most brilliant tonality. This window measures ninety square metres.

At the Louvre the former Salle des Etats, closed for many years, was a few weeks ago opened to the public. M. Guillaume, architect to the Louvre, has made of it one of the most beautiful halls of the Museum. It is very well lighted through the ceiling, whose frieze, which is very rich, is occupied by a range of medallions extremely well arranged, representing the principal artists of the French school. Under each of these medallions, which number sixteen in all, is a garland of flowers, and on each side figures of genii which form a very elegant and well-studied motive. Above the two doorways, still in the frieze, are two vessels' prows, upon which are tall draped figures. To this hall have been carried many paintings, which, many years ago, were banished to the upper stories of the Louvre, and also some more modern paintings: "La Baigneuse," by Ingres; a panoramic landscape, by Chintreuil, charming with its morning freshness and light; two chef-d'œuvres of Troyon, "Oxen Going to Work," and "The Return to the Farm"; several Theodore Rousseau's; Courbet's "Combat of Stags"; several Dalacroix; among others "The Taking of Constantinople," which used to hang in the Museum at Versailles.

Now, what more can I add of interest? We are unfortunately at a time of year when the artistic movement does not flap its wings with a full stroke. No important exhibitions, no *Salon*, no competitions. Let me hope that if I have the honor to send you another courier the matter will be more abundant and the reading more entertaining.

M. Brincourt.

TRAP SIPHONAGE.

Washington, D. C., January 17, 1887.

To the Editors of the American Architect: —

Dear Sirs, — I see that you have published, in connection with my report, Mr. Putnam's reply thereto. When this reply was forwarded to the Museum of Hygiene, Dr. J. T. Turner, in charge, handed it over to me for examination, to see if his exceptions were well taken. The enclosed circular was my answer.

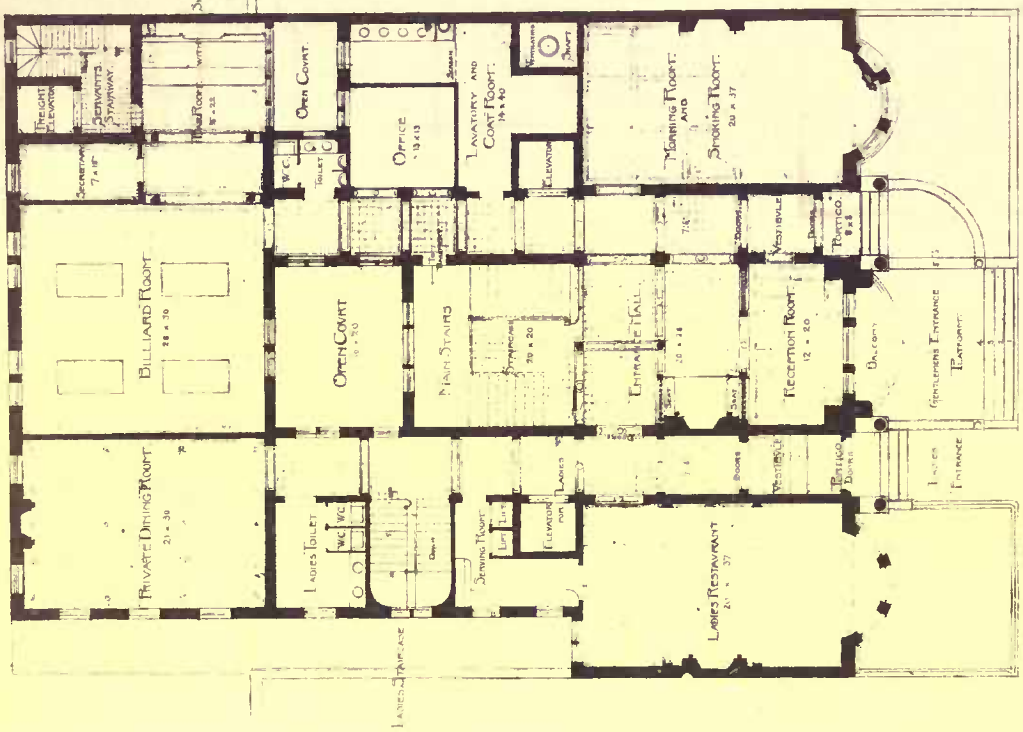
Mr. Putnam's reply was published on his own authority, no other authority being necessary, and at his own expense. Simply in the interest of fairness was it distributed with my report; he fearing the effect of my experiments on some of his manufactured articles.

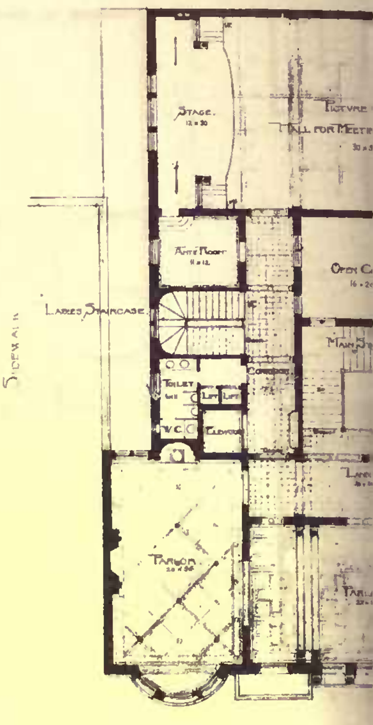
As many, and I think all of Mr. Putnam's exceptions are misleading, I would like, and I think it would be right and proper, for you to publish my answer with this explanatory letter. It may be well to

Academy of Music, Macon, Ga.
Alexander Blair: Arch't.



Heliotype Printing Co Boston





Plan of Sec

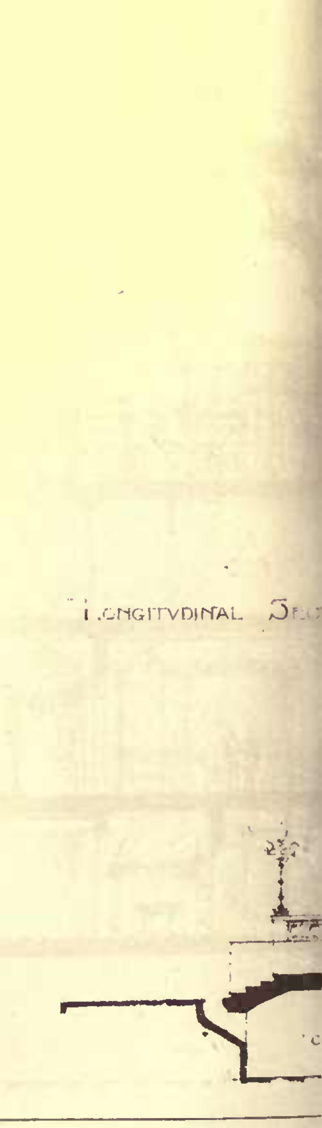
Principa



Perspective: traced from Pencil Drawing

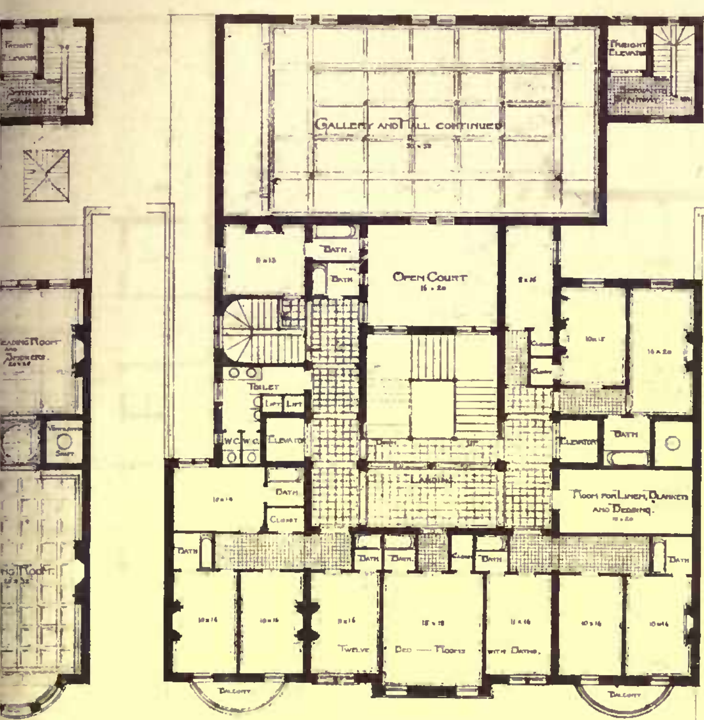
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Competitive

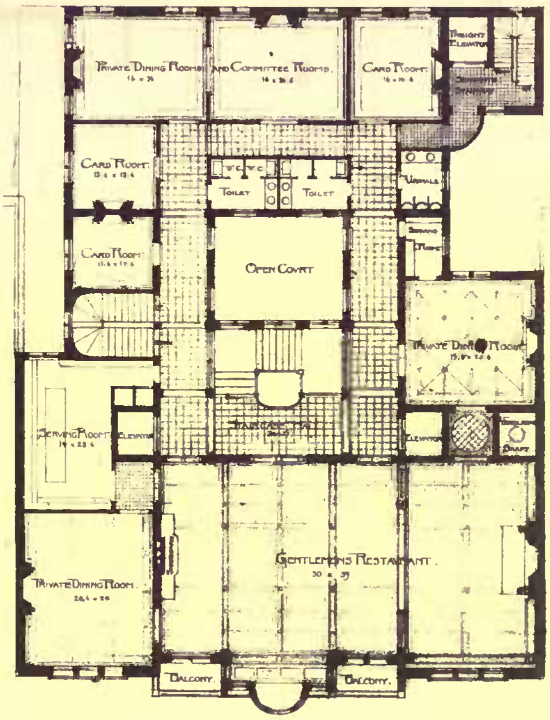


Longitudinal Sec

Heliotype Printing Co. Boston

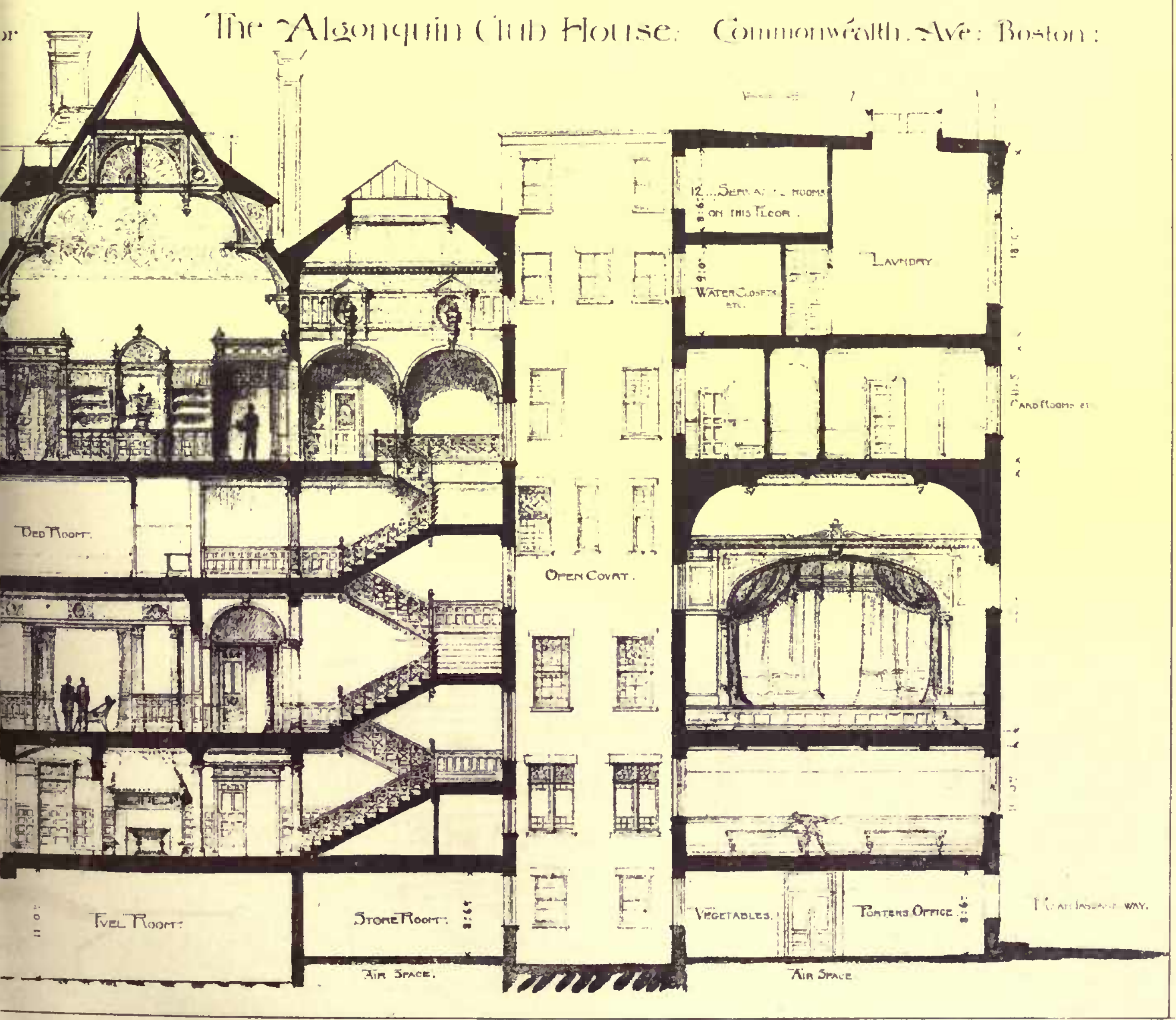


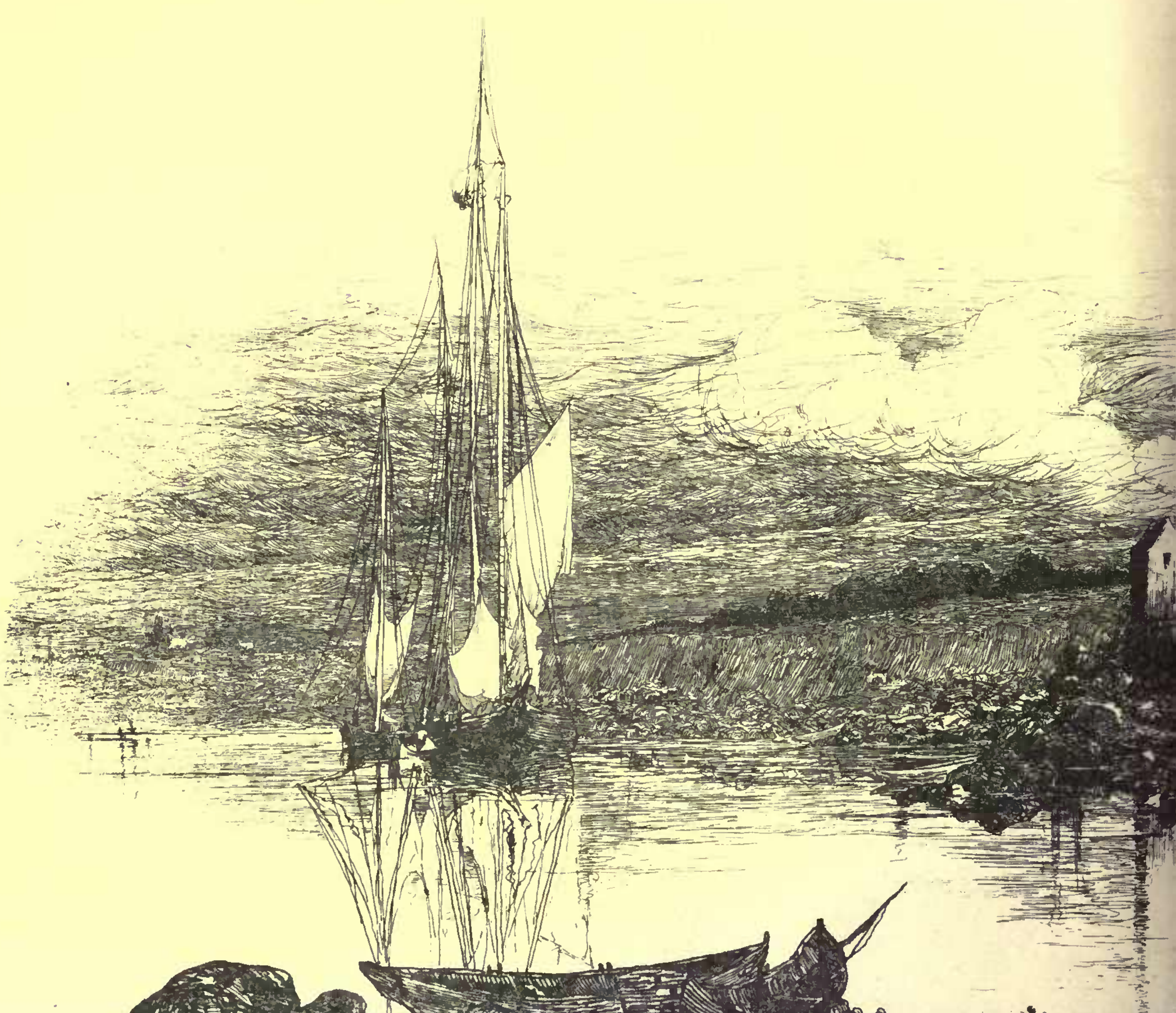
Plan of Third Story
Intermediate or Bedroom Floor



Plan of Fourth Story or Restaurant Floor.

The Algonquin Club House: Commonwealth Ave: Boston:



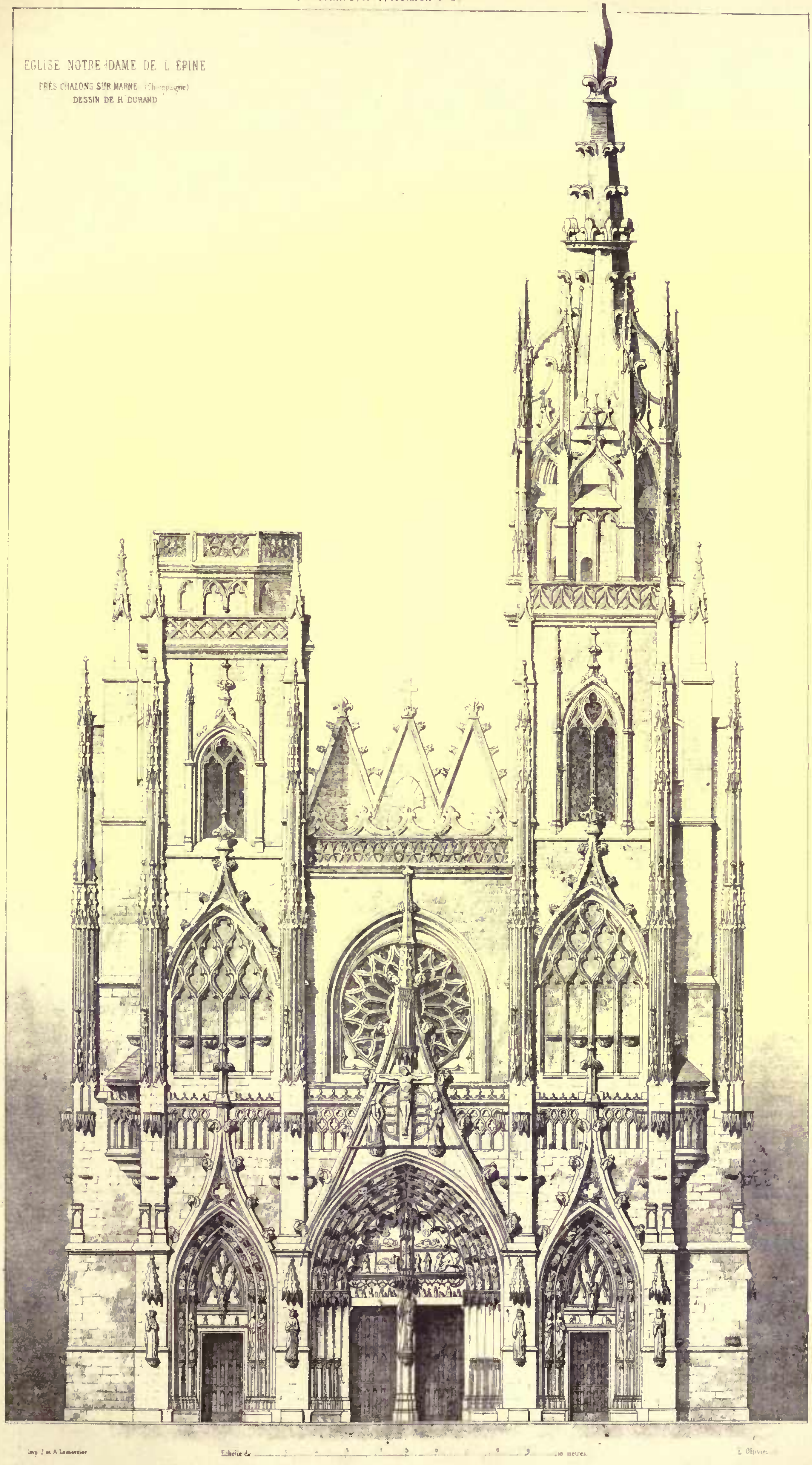

Stephen Parrish

R & Co



Heliotype Printing Co Boston.

AMERICAN ARCHITECT AND BUILDING NEWS, JAN. 29 1887. No. 579



state that I do not intend to be drawn into any further controversy in the matter, Yours truly, GLENN BROWN.

A DISSECTION OF MR. J. PICKERING PUTNAM'S REPLY.

In answer to Mr. Putnam, I think it only necessary to make a running comment on the points of exception as laid down in his reply, to show the fallacy in each.

Answer to His Introduction.

Trap ventilation does not add enormously to the expense, complication or at all to the defectiveness of plumbing. The apparatus at the Museum is arranged more nearly in accordance with the methods in ordinary use then has been the case in other experimental plants. The *Sanitary Engineer*, the best authority, says editorially in reference to the experiments, apparatus and conclusions, "that they were evidently conducted to get at the real facts, no unusual conditions were arranged, and no misleading conclusions were drawn."

Answer to Points in Mr. Putnam's Pamphlet.

(1) I agree that I have striven after the truth, and feel confident that I have obtained it in the conclusions drawn. Having no commercial interest to serve, I have endeavored to treat all alike.

(2) The vents, the area of which was varied from 0 to 3 inches, and the length from 3 to 42 feet, cover every contingency in practice. It was not intended to adhere strictly to scale in the drawings, as all the sizes of pipes and traps were printed in the Report, such a small scale being an approximation at the best.

(3) The vent-pipe used and as shown in drawing of my report, runs first horizontally 6 feet, thence vertically 29 feet, thence horizontally 7 feet, thence vertically about 2 feet, very much as shown in Mr. Putnam's cut on the right hand (Fig. 2) as an example of actual work. His cut is misleading, showing vent as being cut off at tank, he having inadvertently omitted my plan.

(4) Same answer as No. 2.

(5) I have found the S-trap when properly vented retains its seal against back-pressure and siphonage when no trap without ventilation would.

(6) I have found that sewer air is driven into the house by back-pressure from friction in the pipes and that no special bend can be located as the point of such friction. The sides of a straight pipe seem to cause all the friction that is required for such back-pressure. If the assumed objectionable bend should be located and the waste attached below the bend, in some cases, if not most cases, the waste-pipe would approximate the length of the soil-pipe. For instance, wash-basin in third story, assumed frictional bend near the fresh-air inlet outside the house, the waste-pipe would necessarily run through three stories and cellar. Back-pressure of this character does not force the water up as a mass into the pipe between the fixture and trap, but the sewer air is forced through the seal in the form of bubbles, as I have stated in my experiments. No matter how far below the fixture a trap was placed, the sewer air would be forced through the trap. This distance is shown in Mr. Putnam's Figure 2 in its most favorable light, yet what a needlessly long waste, and what a space between wash-basin and trap to become foul.

(7) My experiment shows that there is a minimum point beyond which vents should never be reduced.

(8) The lead pipe collapsed only when the roof outlet was closed. A few tests only were made under these conditions. I am afraid that the inference drawn from this point would be that all the tests were made under similar severe strains, although, of course, it was not the writer, Mr. Putnam's, intention to convey such an erroneous impression.

(9) The experiments show that when the vent is simply closed, S-traps as well as all others are siphoned because there is no vent. The Sanitas trap likewise siphons when the top of the soil-pipe is closed.

(10) Clogging of vents as well as the methods of placing them to prevent clogging are mentioned in my experiments.

(11) The top of soil-pipe when open has the same relation to the tank as the overflow would have to a fixture. This was open in a larger number of the experiments tried. Mr. Putnam's readers might here again take the erroneous impression from his text, that this severe test was applied in every case.

(12) Traps fill from the ordinary waste water in the fixtures when siphoned from the discharge in the fixture above the trap; in that case the trap being emptied only to the line of the seal.

(13) This question goes outside of my report, but I have made experiments which show the time taken to break the seal of a trap by ordinary evaporation is so great that practically it need not be considered.

(14) This is so only in a limited degree. I find Mr. Putnam's trap (the Sanitas) better than the other unvented traps in regard to siphon action, but it is more easily effected by back-pressure than the ball-traps. I consider Mr. Putnam in error as to his trap being more severely treated than the vented S-trap.

Comments on Mr. Putnam's Conclusions.

(1) I see no reason to change my deduction that properly vented traps are safe against siphonage and back-pressure.

(2) I find the seal of anti-siphon traps, Mr. Putnam's included, are not anti-siphon under all contingencies, and that they do not withstand back-pressure.

(3) The necessary expense in protecting the seal of traps by ventilation is not only justifiable but expedient.

(4) I only see one practical way of preventing back-pressure; that is by ventilation.

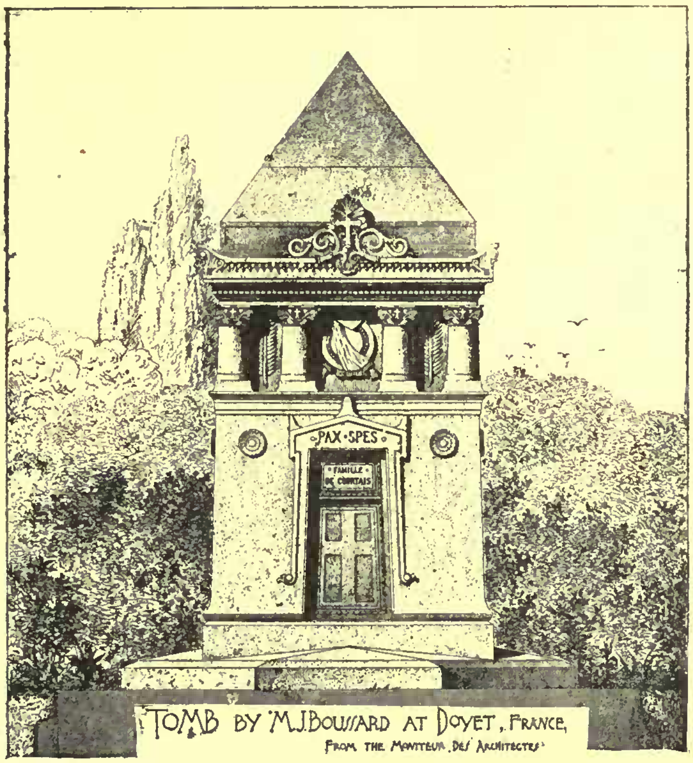
(5) From my experiments, and further, from this discussion, I conclude that vents of the proper size should be required by law.

After careful survey of the subject, I can see no need of further experimentation on the points under discussion, and consider the deductions as drawn up in my report as firmly established by the experiments at the Museum of Hygiene.

I do not consider trap-vent laws as perfect as the writer seems to assume in several instances. Mr. Putnam was not authorized to state or imply my assent to any of his propositions.

Yours respectfully,
GLENN BROWN.

TO DR. T. J. TURNER, DIRECTOR U. S. N.,
Bureau Medicine and Surgery, Washington, D. C.



TOMB BY M. J. BOUSSARD AT DOYET, FRANCE.
FROM THE MONITEUR DES ARCHITECTES.

REPLY TO MR. BROWN'S "DISSECTION."

THAT a writer should be allowed to publish, uncorrected, very serious errors in matters of fact upon which some of the most important questions in sanitary plumbing are hinged, in Reports to Government Officials at the Museum of Hygiene, based on apparatus erected in part at the Government's expense, and that these errors should be reprinted uncorrected in the leading sanitary and engineering periodicals of the country, shows a very lamentable state of affairs, and promises that, for some time longer at least, our plumbing laws are quite as likely to be founded upon illusions as upon facts.

In matters so directly affecting the health and welfare of the entire public, why should so much uncertainty and ignorance be allowed to exist? Why should the investigations and practical experiments be left to private individuals? A small proportion of the money spent by the public in complying with burdensome and unnecessary exactions in the plumbing laws, would pay for a series of scientific experiments which would definitely settle these disputed points and remove unsound theories and the objectionable features in the laws which are based upon them. If it is thought unnecessary to erect new apparatus for making these experiments, why should not the apparatus already erected by private enterprise be employed for experiment by some commission at once competent and disinterested, appointed either by Government or, as has been wisely suggested, by the *American Architect*, by scientific bodies interested in the subject and in the public welfare?

The apparatus used by myself for such experiments could undoubtedly be availed of, and would, I am certain, be found to be suitable to yield a positive and satisfactory answer to all the important questions at issue. I refer to the apparatus used in the experiments for the Boston City Board of Health, which was erected not for these tests alone, but for actual plumbing service in the building, and which was representative of the average plumbing work built in the better class of houses to-day.

The apparatus erected at the Museum of Hygiene, on the contrary, was not representative of practice, and was built outside of the building in the open air, exposed to the elements. Hence tests on

this apparatus, especially to investigate the question of evaporation, would evidently be totally unreliable. Moreover, the size and arrangement of piping was altogether unusual, and the apparatus employed for producing siphonage was such as would never be found in plumbing practice.

Most prominent among the errors committed by Mr. Brown in common with others who jump at conclusions in this field without great caution and thorough study, are his assertions regarding back-pressure and evaporation. In general, he attaches great importance to the first, notwithstanding the fact that our modern improvements in sewer and soil-pipe ventilation have really deprived it of its power for mischief, while he quite ignores the latter, which our modern trap-vent laws have rendered a really formidable source of danger.

We will take, for illustration, the sixth clause in Mr. Brown's "Dissection," which reads thus: "I have found that sewer-air is driven into the house by back-pressure from friction in the pipes, and that no special bend can be located as the point of such friction. The sides of a straight pipe seem to cause all the friction that is required for such back-pressure."

This statement is altogether at variance with the facts. It would have been easy for its author to have learned the contrary either from simple calculation, from direct experiment, or from what has already been published on this subject.

The sides of a straight pipe do *not* cause the friction required for back-pressure. To satisfy ourself of this without calculation or reasoning, it would only be necessary for one to remove the bend and trap, the true and only cause of back-pressure at the Museum of Hygiene, and repeat the test on the straight pipe without them, it would then be found that the water in the traps would in no way be affected by back-pressure, even under the severest tests applied. Any one familiar with the principles of hydraulics and pneumatics would have known this, and practical experiment here might seem superfluous. Nevertheless, the experiment has been made on the apparatus used by me, which is shown in the annexed cut. The first experiments on back-pressure were made with a double bend at the foot of the perpendicular run of soil-pipe connecting it with the horizontal iron drain in the cellar. Unusually severe strains were brought to bear upon the trap-seals in some of the experiments in order to produce the strongest possible back-pressure.

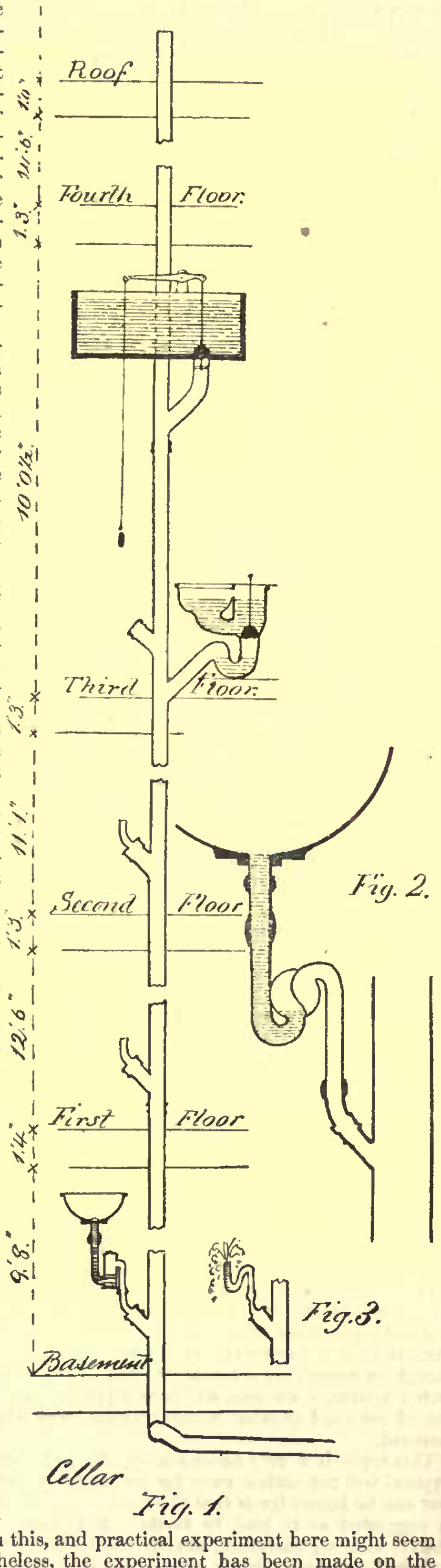


Fig. 1. Fig. 2. Fig. 3.

For this purpose a tank with four-inch plug-outlet therein, similar to the arrangement employed at the Museum of Hygiene was used in the third story. The strains were severe enough to siphon out clean an S-trap fully vented at the crown with a one-and-one-quarter inch vent-pipe ten feet long.

It was found that a powerful back-pressure was produced by the falling-water piston at the lowest branch-outlet in the basement just above the bend. On the first floor the back-pressure was light and on the second floor it was still more feeble, and would produce no injurious effect whatever on trap-seals however placed. In all cases this pressure could easily be resisted and the entrance of air-bubbles from the soil-pipe entirely prevented by a column of water in the trap from twelve to sixteen inches high, measuring, from the top of the fixture outlet to the bottom of the trap-seal. The back-pressure decreased rapidly as the branch receded from the bend at the bottom of the soil-pipe.

This bend was now removed leaving the lower end of the soil-pipe open, and the experiments were repeated, all the conditions otherwise being the same.

At no part of the pipe could the slightest trace of back-pressure on trap-seals connected with any of the branches be perceived. Not the slightest movement or vibration due to back-pressure was developed. But every S-trap seal, though fully vented, was instantly destroyed by siphonage after the current had passed the mouth of the branch, showing the severity of the trials. Experiments for back-pressure were made under a great variety of conditions producing strains of every degree of force. These have already been described in our Report to the Boston City Board of Health, and need not be repeated in detail here.

All our experiments showed, first, that back-pressure is caused by some sudden bend or obstruction in the pipe, and never by mere friction along its sides; second, that back-pressure strong enough to require any special provision to guard against it in plumbing practice could only be developed close to such bend or obstruction; third, that the "Sanitas" trap, or any trap holding a body of water sufficient to fill a pipe between the outlet of the fixture and the bottom of the trap-seal, and placed far enough below the fixture to give this pipe, from the top of outlet to the bottom of the trap-seal, a length of from twelve to sixteen inches, would be capable of resisting the severest back-pressure that could ever be encountered in good plumbing. To give this length of pipe would only require a trap to be set three or four inches, at the outside, lower than is now generally customary. Indeed it would be impossible to set most traps much higher than this on account of their form and of the arrangement of the fixture outlet couplings. Pot and round traps are usually set as low as the floor boards; finally, fourth, that no bubbles from the soil-pipe could ever be driven by back-pressure through the seal of a trap so formed and placed, for it is evident that no air can be forced through so long as the dip of the trap remains covered with water, as shown in Figure 2. A trap formed and set as shown in Figure 3, on the contrary, would permit air-bubbles to be pressed through it.

All this is self-evident to any one familiar with the movement of fluids in traps.

Mr. Brown makes the assertion that "The Sanitas trap likewise siphons when the top of the soil-pipe is closed." A plumber's trap is "siphoned" when its seal is destroyed by siphonage in *plumbing work*, not when it is pumped out by a force-pump nor exhausted by apparatus never encountered in plumbing.

The "Sanitas" trap has never been siphoned in plumbing work, and the implication that it has has no foundation in fact.

The other paragraphs in Mr. Brown's "Dissection" have been sufficiently met in my reply to his original report, and need no further consideration. Respectfully yours,

J. Pickering Putnam.

[As one of the parties to this discussion has signified above his intention of saying nothing more on the subject, it is, perhaps, hardly worth while to say that we do not care to have it continued in our columns, since, unfortunately, the statements and deductions of individuals are always open to the accusation that they are influenced by unjustifiable personal bias or positively interested motives. If this question, and many others of great importance connected with sanitation in which the public is interested, is ever to be settled, it can only be through the unchallengeable action of a public commission appointed by public authority, and if ever such a commission is entrusted with the work its membership must include not only sanitary experts, but master-plumbers, architects and physicians. We will take part in the present discussion only so far as to point out that while siphonage of traps is a very real danger since it leaves a free passage into the house for the foul gases of drains and sewers, back-pressure is a very unreal danger, that is, it is limited in extent and infrequent in action. It must be very rarely indeed that back-pressure is so violent as to eject the water not only from a trap but wholly out of a fixture and onto the floor, the only action that would leave the trap unsealed and a free connection between room and drain. As to paying serious attention to the forcing of a few air-bubbles through a trap-seal by back-pressure it seems to us rather absurd; for even if the results of Dr. Carmichael's experiments, which proved the innocuous qualities of sewer gases that had passed through a trap-seal, have been disproved — and we cannot remember that they have — we have the practical evidence before us of the very real existence of a class of working plumbers, who in the course of a year must breath more undiluted sewer gas than reaches the interior of a house in a lifetime, after being strained through water-seals by back-pressure. — Eds. American Architect.]

Fire and Water tells of a workman in Paterson, N. J., at work at the top of an iron smoke-stack, who was so lucky when the stack fell as to tumble into it feet foremost, and slide to the bottom. Friction and atmospheric pressure together with the inclination of the falling tube allowed him to reach the bottom comparatively unhurt.

THE REMOVAL AND DESTRUCTION OF ORGANIC WASTES.

FROM REVOIL'S ARCHITECTURE ROMANE.

THE problem of removing and of putting beyond the power to do harm — that is, of destroying — organic wastes is a large one, and one which has been taken up almost *de novo* during the active life of men who are still active in the work. It is not to be wondered at that the appalling magnitude of this problem has caused it to be regarded as an intricate and difficult one. Efforts toward its solution had to be made with the means at hand, and under the guidance of men who, however learned, had no precedent to guide them and no positive indication on which to base their theories. Much of the early work was crude work, and all that has been done has stamped itself on professional tradition to a degree that has sometimes given great impetus to false starts.

As we now understand it, the problem, great though it is and difficult though it is, is not an intricate one. It is by no means to be understood that we have reached its best nor its complete solution. It does seem clear, however, that we now know enough of its factors to apply ourselves much more intelligently than our predecessors could do, to its practical solution.

Among the traditions that have become most firmly fixed in the popular mind is the one which is indicated by the technical word "conservancy." For a long time it was believed that the most effective means of relief lay in the improvement of methods for storing refuse matters. Paris, which not many years ago believed itself to have the best sanitary system in the world, and which is still mainly dependent on that system, established regulations which are still enforced, and enforced with much success, providing for the storing up on the premises where they are produced, of all of the worst parts of personal and household waste. To-day, save where certain costly and not very good alternatives are adopted, every householder is required to provide a vast subterranean vault of prescribed dimensions, tightly cemented and practically unventilated, in which all water-closet and kindred matters must be stored, these great receptacles being emptied, sometimes by pneumatic processes and sometimes otherwise, only as they become filled. Practically, the whole city is to-day reeking with festering accumulations of the worst forms of organic wastes, producing conditions which give it a sick-rate and a death-rate far beyond anything that is known in this country — typhoid fever being always fatally present.

Even before anything like positive knowledge on the subject had been developed intelligent sanitarians had come, by instinct or by accident, to the idea that the whole principle of conservancy is radically wrong. This idea has been reinforced and established by the light thrown upon the subject by biological investigation. We are beginning to divest ourselves completely of all our former notions, and to adopt a simpler and far more rational way of treating the whole question. It is now a generally-accepted idea that relief from the evils against which we have so long contended is to be sought by the complete removal and the absolute destruction of all organic matter which can no longer be useful to human life. The means of removal, it is the office of the engineer to provide. The means of destruction, a necessary sequel and complement of the engineer's work, are to be regulated according to what we know of the almost universal processes by which nature breaks up the combinations of organized matter, and prepares its elements to enter again upon the unceasing cycle of nutrition and activity and subsequent death and dissolution.

In this destruction of the organic character we are dependent, almost, if not quite entirely, upon the development of minute organisms, of which the *bacterium termo* is the type, and apparently the master. This is the bacterium of ordinary putrefaction, active everywhere in the world wherever dead organic matter is exposed to contact with the air at ordinary temperatures. Much of our refuse, before becoming subject to bacterial action, is made to serve the uses of other organisms. It may become food for fishes or for insects, but sooner or later it all falls a prey to those microscopic organisms whose means of life and whose reason for being is to break down the last vestige of organic character.

Making due allowance for what is used to nourish higher orders of life, we find our main problem now reduced to the comparatively simple one of bringing our waste matters, as rapidly and as inoffensively as possible, into such a condition and with such surroundings that they may become subject to putrefaction and similar processes of decomposition. The experience of Tyndall, Koch, Pasteur, Sternberg and other investigators has shown that organic matter of whatever kind, shielded from the access of the organisms of which bacteria are a type, or so protected against the access of air that these bacteria cannot develop in them, will withstand putrefaction for an indefinite time. Sterilized solutions rich in organic matter remain clear so long as the infection can be withheld. Organic wastes, deeply embedded in compact wet clay, are preserved indefinitely, but the moment we admit air and subject them to infection by a single floating spore of a destructive organism, that moment their process of dissolution is begun, and the stability of their organic character is doomed.

To apply the illustration to the more tangible matters with which we have to deal, as, for example, to the outflow of a city sewer, we see that so long as it is prevented from contact with oxygen in the atmosphere or in the contained air of water-courses or of the sea, so long does it remain waste organic matter, capable of developing hurtful and dangerous qualities. Once subjected to active decomposition, it seems to yield rapidly to the natural influence and to be resolved into its elements. Therefore, the ultimate solution of the question seems to lie in putrefaction and nitrification. Its safe solution lies in such regulation of its putrefaction, in kind and in locality, that it can no longer do us harm.

Based on the conditions suggested, the more enlightened sanitarians of the world are in accord in believing that the only sure and safe way out of our difficulty lies in the complete removal of all manner of organic wastes away from the neighborhood of habitations, and its disposal under such circumstances as will lead to its rapid decomposition. The cardinal rule should be that every organic substance of whatever sort, when its usefulness has passed and when its stability is threatened, should be immediately and completely removed to a distance. Being so removed, the safety of the household or community by which it was produced is essentially assured. Its subsequent history is interesting chiefly with reference to those into whose presence we may have sent it. Their safety is to be secured by insuring its destruction under conditions which will not favor the pernicious results attendant on restricted and aborted decomposition.

It seems prudent to predict that the world will before long accept what now seems to be the demonstrated proposition, that all that we need consider with regard to the organic wastes of municipal life — the drainage from houses, the wastes of slaughtering establishments, the organic outflow of factories, etc., — to prevent their interference with the health and life of the community, is to get them out of our neighborhood while still in their fresh condition, and then to secure their rapid resolution into their organic elements.

Briefly, *speedy and complete removal with speedy and complete decomposition*, is the formula by which all our work should be guided.

It is simple and easy to say this, but it is neither simple nor easy to secure the application of such a formula in its entirety to the wastes of a community or even of a single house. Nearly everything connected with the question is subject to the influence of prejudices and preconceived ideas, to such a degree that a simple statement of all that is really effective is regarded as hypothetical, and suggestions for improvement are met at every turn by fears and doubts based upon conditions attaching to the old conservancy system. For instance, it would probably be very difficult to make the authorities of the City of Baltimore understand practically — they pretend to understand it theoretically — the vital importance of getting rid of every deposit of such matters within the limits of the city forthwith and permanently. Those authorities would probably accept as a good compromise a system by which privy-vaults and cesspools should be made absolutely tight, and should be emptied by pneumatic process once a month; although, if they examined the matter critically, they would doubtless realize that within a week the accumulated mass would be in active fermentation, and that that condition would extend itself promptly to all of the fresh matters which are being constantly added to the mass. They would probably consider it a subject of congratulation if the whole city could be, without cost, provided with large brick sewers built after the Paris and London plan, for the partial removal and the complete concealment of what was sent into them; though, if they examined the matter critically, they would realize the truth of the old expression with regard to such sewers that they are little better than "elongated cesspools," not, it is true, filled with deposits, but retaining such an amount of deposit and maintaining such a state of decomposition as to produce all the pernicious aeriform results which we recognize in the case of the cesspool.

Were a system of complete, quick, and cleanly removal submitted to them for an opinion, and were it one feature of the project that the sewers of the system should be ventilated by untrapped drains and soil-pipes, more than one of them would at once object to the admission of "sewer-gas" into pipes which pass through houses; though on examining the subject critically they would see that under such a system, sewer-gas, which is a product solely of the putrefaction of retained organic matter, cannot exist where all is promptly removed.

This topic is a very far-reaching one, and the short time at our disposal will not suffice even for its casual examination. The most that can be hoped for is that the cardinal principle involved may be so suggested as to lead to further and useful consideration and study. Let us, therefore, sketch hastily the works that might be proposed for the drainage we will say of a town of 10,000 inhabitants, sloping toward a natural valley running through it, and having a general and sufficient fall through and beyond it in the direction toward which the valley trends. For simplicity, we will disregard the treatment of storm-water, which, as the town has grown, is quite sure to have been met in some practical and tolerably effective manner. With regard to its foul drainage, let us fancy for the moment that we have absolute power and a sufficient appropriation to treat it as we like. We will lay through every street or alley, one or the other, according to circumstances — a net-work of sewers reaching

the immediate vicinity of every house-lot, the sewers joining each other as they go on, until finally the whole are united in one main trunk-sewer passing out of the city limits at the lowest point.

The purpose of these sewers is to remove foul drainage and nothing else. The sizes may therefore be established on something like an intelligent basis. We have not to provide for occasional enormous contributions of storm-water, but only for the daily outflow of houses which use about the same amount of water day by day, and industrial establishments which produce about the same amount of waste week by week. For simplicity again, we will not consider the provision needed for an increase of population.

The characteristic element of the system would be a lateral sewer of the smallest size, running for as great a distance as that size is applicable to. For reasons which will bear investigation, let us adopt a diameter of six inches, maintaining this size until the direct sewer and the tributaries entering it aggregate a length of 2,000 feet. Making due allowance for street-crossings, unoccupied land, etc., let us assume that there is, on one side of the street or the other, and on the average one house for every 25 feet of length. This will give us an aggregate of 80 houses, with a population let us say of 600, producing a maximum daily amount of sewage equal to 30,000 gallons, or 4,000 cubic feet.

As more water is used, and more sewage discharged during the forenoon than during the afternoon, and more during the day than during the night, let us suppose that one-half, or 2,000 cubic feet, would be delivered in eight hours, 250 in one hour, or, with a margin for error, five cubic feet in a minute. A six-inch pipe laid with the least inclination suitable for such a pipe, or on a fall of 1 to 300, has a capacity of discharge of more than 23 cubic feet per minute, so that, so far as the accommodation of the stream is concerned, our limit of 2,000 feet length, in a closely-built area, is very well within the mark. It is not desirable, however, that the sewers should ever be taxed to anything like their full capacity; they should have ample space above the flowing sewage for ventilation, and should be large enough to transmit — without an opportunity to accumulate and form obstructions — everything that can come to them through a four-inch house-drain.

Throughout the lower portion of the sewer, 2,000 feet long, there would be at all times a considerable flow, so that whatever objects coming from houses may be delivered into it, will be swept along and carried to the outlet without forming deposits. Throughout the upper portion of the line, however, the flow will always be less, will often be slight, and will at times be practically absent. At such points, it is found by experience that solid matters delivered by house-drains in the ordinary volume of water used in discharging a water-closet, for example, will not be carried forward through the six-inch pipe. To a greater or less extent, they will be stranded by the way, and unless some special provision is made for their removal, they would in time accumulate to a degree which would produce a very objectionable seat of offensive decomposition.

To obviate this difficulty, to pick up all stranded substances and sweep them forward into the constant current, we resort to artificial flushing. We cannot trust to nature to flush our sewer properly with rain-water, because, sometimes for weeks and weeks together, nature withholds its provision. We cannot trust to hand flushing for proper efficiency, because of the difficulty of securing the regular and proper performance of such duty by ordinary town employés, and because of its inordinate cost. The best we can do is to adopt a system of frequent flushing by automatic flush-tanks, so that, without care or thought on the part of those who have charge of the work, the regular, copious daily cleansing of the whole system may be depended on.

As already suggested, the sewers, as they come together, and as their length increases, will increase in size. We may assume that for the community under consideration the main sewer as it leaves the town, having a fall of 1 to 500, will have a diameter of 15 inches. If removing only the foul wastes of such a community, this main sewer would never run half full.

The system described, so far as street sewers are concerned, will secure the absolute removal of everything delivered into them at least as frequently as the operation of the flush-tanks takes place — say once in 24 hours.

To secure the full benefit of this system, so far as the interior of the town is concerned, it should be rigidly provided that every house shall be, in all its parts, provided with appliances for drainage, constructed on the same principle of complete and constant cleanliness. Every water-closet, sink, wash-tub — everything that receives organic wastes, should at each use discharge a sufficient volume of water to secure the complete transportation of all solids all the way into the street sewer. Once delivered there, the sewer itself will take care of them, and we shall have removed from our houses as well as from our town everything which might become offensive if retained.

The system of house-drains removes it from the houses; the sewers remove it from the town, and we have now to consider the question of ultimate destruction.

The material that we have to treat is free from putrefaction; it is little more than dirty water. It contains, of course, the fæcal wastes of the population, but these are distributed through such a mass of water that they have completely lost their original offensive character. The problem, simply stated, is: to secure the complete disintegration and destruction of the organic parts.

[To be continued.]

THE EFFECT OF ADDING SACCHARINE MATTER TO MORTARS.

A LETTER from Mr. Thomson Hankey "On a New Use of Sugar" — *Times*, October 13 — has given rise to wide discussion and inquiry. At a time when the price of sugar is so low, and, as I shall show when the use of a very small quantity of it, or of treacle, adds largely to the strength of mortar, and makes Portland cement itself set with great rapidity, it seems to me that I may do a service to engineers by laying before them the scientific grounds on which I was led to experiment on the subject, and the remarkable results which have been obtained.

The practical importance of this addition of saccharine matter to mortar I will state briefly to begin with, and will give a few illustrations.

I mixed in a small jar some Portland cement and brown sugar, adding water and stirring. I took out a little of the cement for an experiment, and when I tried an hour after to take out more, I found that the remainder had already set.

My neighbor, Mr. Rowland, weighed carefully Portland cement and sand into four small jars. To two he added different sugars, to the third treacle, but to the fourth no saccharine matter. On the following day the cement had set — we do not know how much earlier, for it was not examined — in all the jars with saccharine matter. Mr. Holden, Jr., the foreman of a builder, examined all of them on the Monday following the Friday on which they had been mixed. On pressing the cement to which the treacle had been added, he said, "I might press the bottom of the jar out before I can make an impression on this." He then put his finger into the jar in which there was no saccharine matter, and stirred up the cement, which had not set at all, and which did not set till a day or two after. It may be objected that it might not be an advantage that it should set so quickly. This objection will be answered by-and-by as I proceed, by showing that it is highly probable that the strength of Portland cement will be greatly increased by this addition of saccharine matter.

Mr. Thomson Hankey had experiments made, first, by his own brickmaker, and secondly by a house-builder. Both reported that the addition of sugar made a common lime equal to Portland cement.

The bearing of these facts will be plain to every engineer, but I cannot forbear mentioning here a startling incident. The Ecclesiastical Commissioners built for the late Bishop Fraser, of Manchester, on his coming into the diocese, a lodge like that at Lambeth, with a lofty archway set in Portland cement. A clerk-of-the-works appointed by the architect of the Commissioners superintended it. After a due time the scaffolding was removed. One day — perhaps that day — the bishop walked through, and had just got beyond danger, when the whole of the archway fell. If he had been under it, he would have been killed, and his grand career as a bishop would have been cut short at the outset. Your readers, as I proceed with my statement, will judge for themselves whether the additions of a few shillingsworth of treacle would not have made all secure, and have saved the expense of doing this work over again.

I have to explain how it is that sugar, or rather saccharine matter of any kind, produces this remarkable effect on lime. Here I ought to mention that I am a retired physician, and that the idea of putting the matter to the proof arose in the following manner. In medicine we have two kinds of lime-water: one, the common lime-water that can be got by mixing lime and water. It is to be particularly noted that, add as much lime as you like, it is impossible to get water to dissolve more than half a grain of lime in one ounce, or about two small tablespoonfuls of water. But by adding two parts of white sugar to one part of lime, we obtain a solution containing about fourteen-and-one-half times more lime in the same quantity of water. Here it is to be observed — and it is a most important point — that there are hot limes, such as Buxton lime, which, if the sugar be incautiously mixed with them, will *burn* the sugar, make it a deep brown color, and convert it into other chemical forms, and possibly, and I think probably, will destroy its value in mortar. The way to use sugar with such limes is to dissolve it first in the water. I dwell particularly upon this, because a gentleman referred to me by Mr. Thomson Hankey, in writing to thank me for the information I had given him, casually observed that his cement had turned nearly black by the addition of the sugar. Probably many other experimenters with sugar and hot limes have had the same result, and are in the belief that all is right. Our strong medical saccharated lime-water looks like water.

Ten or fifteen years ago I had been experimenting with lime and sugar, but not in reference to mortar, and I spoke about that time to my friend, the late E. W. Binney, F. R. S., about this property of sugar. He said that it was very curious, and that it was new to him: and he told me this anecdote, that in his grandfather's time an Italian architect came down to Worksop to erect a building for a nobleman, and insisted on being supplied with malt to make his mortar with; the malt was supplied and used. Many years afterwards, this building had to be taken down; but, said Binney, "they could not pull it down, do what they would, and they had to use gunpowder."

I said, it would be the saccharine matter in the malt that produced this result. He agreed with me.

A few months ago I was at Peterborough, and went to see the progress of the restoration of the cathedral, where I made the acquaintance of Mr. Irvine, Mr. Pearsons's clerk-of-the-works. Mr. Irvine was for more than a quarter of a century with Sir Gilbert Scott, and possesses a greater knowledge of architecture, and antiquity bearing on English architecture, than any one I ever met with.

One day I said to him that I had been to Fotheringay. He replied that he had seen every other church than that in the neighborhood of Peterborough. I asked him to go with me on his Saturday's half-holiday, as my visit to the church had been a hurried one, and I wished to make some further inquiries. Besides, I was glad to have the companionship of one who was so thorough a master of the subject. The chancel of this fine church, built before the nave, and so late as 1410, has entirely perished; and it had been so badly built that even in the time of Queen Elizabeth it had fallen in and was then in ruins. The chancel and tower exist, but the tower is unsafe, and if the church be not soon restored, this grand historical monument may suffer or be destroyed.

As Mr. Irvine and I walked to the railway station, I asked him whether he was aware of the chemical fact that the addition of sugar to water makes it take up about sixteen times more lime than water by itself does — I might have said a little more than fourteen times. He replied that he did not know this fact, and that he had never heard of it, and that he did not believe that it had been so used in mortars. I then told him what Mr. Binney had told me regarding the building erected by the Italian architect near Worksop. He said that he had been clerk-of-the-works in the restoration of several cathedrals, in the books of which he had met with old entries of payments "For beer for the masons," and that he had found one entry where it was written, "For beer to mix with the mortar." I said that that would be for the saccharine matter in it; and, I added, that a few years ago I had seen in a newspaper that the vintage in Spain had been so abundant that the people had not casks enough, and were using the wine to mix with their mortar. It flashed across my mind that this traditional use of saccharine matter was probably the explanation of the exceptional hardness of the old Roman mortar, and had been handed down from generation to generation, and had at length been forgotten, in England at any rate.

A few days afterwards I was pondering, as I walked along the street in Peterborough, on this matter, when suddenly I said to myself, "Why not try the experiment?" I went into a grocer's shop and bought a pound of exceedingly finely powdered sugar and some beeswax — of the wax I will speak some other time. I took the sugar to the hut in the cathedral yard, where I found the foreman of the contractor and Mr. Irvine. Laughing, I said, "I have come to teach you to suck eggs." After explaining to the intelligent foreman my views, he and Mr. Irvine kindly agreed to try the experiment. Some powdered lias lime and some of the sugar were being mixed together in an iron basin. Water was added, and Mr. Irvine began to stir them with a trowel. No sooner had he done so than he exclaimed, "Look, look! It is beginning to set already." I said, "Is not that usual?" He replied, "No; something very uncommon." The mortar was poured out on the end of a beam where it set. Some more was then made much thinner, and a little sand added to it. With this, which was about the consistency of cream, two largish fragments of the broken-stone tracery of an old window were joined, and so were two bricks, two pieces of glass, and two slates. It would be about five o'clock in the evening. As I was going to leave Peterborough about noon on the following day, I called at the cathedral about ten in the morning to see the results. Mr. Irvine said it was too early to judge. He felt at the stone tracery very tenderly. Holding the upper fragment, he then tilted the tracery sideways, and as the stones held together, he then took hold of the upper fragment with both hands and lifted the whole stone without the lower fragment falling off. In like manner, in lifting both bricks, the lower brick did not fall off. The slate and the glass seemed also set. So that the experiments seemed to confirm remarkably the view I had formed, on theoretical and chemical grounds chiefly, that saccharine matter added to mortar would be of great value, and that an important discovery had been made.

I wrote to my brother-in-law, Mr. Guildford Molesworth, engineer-in-chief to the State Railways in India, and author of "*The Engineer's Pocket-Book*," telling him what we had done. From him I received a letter dated Simla, August 28, 1886, giving me the following interesting particulars: "With regard to your addition of sugar to mortar, it is a practice that has been in use in the Madras Presidency from time immemorial." The following is an extract from the Roorha (?) "*Treatise on Civil Engineering*," Vol. 1, page 150, third edition: "It is common in this country to mix a small quantity of the coarsest sugar — 'goor,' or 'jaghery,' as it is termed in India — with the water used for working up mortar. Where fat limes alone can be procured, their bad qualities may to some degree be corrected by it, as its influence is very great in the first solidification of mortar. Captain Smith attributes the fact that mortars made of shell lime have stood the action of the weather for centuries, to this mixture of jaghery in their composition. He made experiments on bricks joined together by mortar consisting of one part of common shell lime to one and one-half of sand. One pound of jaghery was mixed with each gallon of water with which the mortar was mixed. The bricks were left for thirteen hours, and after that time the average breaking weight of the joints in twenty trials was six and one-half pounds per square inch. In twenty-one specimens joined with the same mortar, but without jaghery, the breaking weight was four and one-half pounds per square inch."

Mr. Molesworth then adds: "The use of sugar and jaghery was known to me when I was in Ceylon twenty years ago. The masons who came over from Madras used to made most beautiful plaster-work, almost like enamelled tiles, of shell lime mixed with jaghery. The surface took a fine polish, and was as hard as marble; but it required a good deal of patient manipulation well suited to the national character."

This intelligence from India supplies proof of the most positive kind of the enormous strengthening power of sugar when mixed with mortar. It may be argued that some of our limes and cements are of themselves good enough without it. It is for engineers to judge whether they might not be made much better by it, or whether the facts I have brought forward do not show plainly that there should be an inquiry instituted by scientific men to investigate the actual *numerical* value of sugar, and the various conditions under which it acts, whether for better or worse. For the worse it cannot act, except such an insane use of it be made by adding too much, as to expect sugar to be itself mortar. The jaghery sugar used in India is sold in the London market at, I think, less than a penny a pound, and is used for feeding cattle. Treacle seems to me to be a most promising form of saccharine matter. I would shirk beet-root sugar. There is a rough, unrefined treacle, which is very cheap, and I should suppose would be excellent. A halfpenny-worth of treacle and water added to a hod of mortar would, I conjecture, increase its strength by one-third, if not by one-half.

But I must leave the matter in the hands of scientific engineers. I think it is very probable that this use of sugar with lime is of extreme antiquity, and that a knowledge of it passed from India to Egypt and Rome, and that these nations used malt for its saccharine matter as a substitute for sugar. I have shown that the mediæval builders used beer in building our cathedrals, and beer is still used with plaster-of-Paris. These I take to be the remnants of ancient tradition. It is said that in the cold winter when Bess of Hardwicke died, her masons had to "melt the beer which they mixed with their mortar." They would have acted more wisely if they had used infusion of malt only, for most of the sugar must have been converted into alcohol, and lost for the purposes of mortar-making. Antiquarians may be able, from old documents, to throw light upon this subject; but I strongly suspect that the old Roman mortar had saccharine matter added to it, and I am of opinion that, in all engineering works requiring great strength, it would be wrong not to take advantage of facts confirmed by the experience of ages. — *The Engineer.*

THE OLD SOUTH MEETING-HOUSE, WORCESTER, MASS.

WORCESTER, January 11, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —



Dear Sirs, — A matter has been considerably discussed in Worcester, and is to be shortly decided, in which you may find some interest, antiquarian and architectural. This concerns the destruction or preservation of the "Old South Meeting-House." Perhaps you may see a way to help on a right decision. The City Government has taken the needed steps to acquire the title from the parish, and there remains the valuation and payment to be consummated and the fate of the old structure to be determined. At the west end of the Worcester Common stand two buildings, at northwest corner the City-hall, and a few rods south of this the old church. The body of the church within and without has been so changed as to have lost all its original features, but the belfry and steeple seem to remain as they were built, about 1760.

The spire is of no great size or beauty, but it is, I think, the only piece of colonial architecture in the city that can claim a monumental importance, and I hope that you will agree with me that it has sufficient historic and picturesque merit to demand an honorable preservation. In a letter published last spring by the *Spy* I suggested that the old spire might be mounted upon a

new stone tower of appropriate design, and that this would be excellently placed in the wide street, called Salem Square, at the east end of the common, which is of size to be used as a hay market, and at its centre has the weigher's office. Devote the ground-floor of the proposed tower to the weigher's use and a reason is given for such a location of the tower. Moreover, that site overlooks a much-travelled thoroughfare, Front Street, and the clock and bell and vane would be where they would serve many.

My idea is to make it a "Worcester tower," where historic inscriptions, bas-reliefs, and perhaps statues of local worthies might later find a fitting place. Could you not interest your readers by publishing such a "restoration" and thus give something that could put visibly before the gentlemen of the City Government and those of antiquarian tastes what it is quite possible to accomplish, with no great expenditure, retaining what is good from the past to make an honorable trophy for municipal pride? In the hope that you may find the theme acceptable I enclose a photograph of the "Old South" and of the proposed site, and an esquisse-esquisse, which, after being suitably (and very largely) improved in your office and put into perspective, I should much like to put in the hands of our aldermen, the members of the two antiquarian societies and the members of the Old South who only relinquished their property under compulsion.

Last month was the centennial of Shay's rebellion, and the newspaper recounted what a sturdy front was presented by General Ward who, as Chief Justice of the court, breasted the bayonets of the insurgents. That would make one figure for our tower. (He had been the *first* American *major-general.*) Colonel Ward, who was killed at the head of the 15th Massachusetts (the Worcester) regiment at Antietam, would make another. Is not Mr. Bancroft the most distinguished living American, and, as a native of Worcester, would not the city honor itself by placing his figure at the third corner of our tower? But, leaving the sculptor's work for the future, does not the simple stone wall, modestly covered with ivy perhaps, and surmounted by the old steeple, appeal successfully to your sympathy and help. Yours truly, H. A. Phillips.

COMMUNICATIONS

A FIRE-PROOF FLOOR.

Chicago, January 19, 1887.

To the Editors of the American Architect: —

Sirs, — In response to "*Enquirer*" of Toronto I wish to say it seems hardly advisable to use timbers for floors of a size as large as 36′ x 39′. These large spans ought to be covered with twenty-inch iron or steel beams at about five feet centres, the arches to consist of two-and-one-half inch fire-clay brick-tiles upon tee-irons, and the floor of either planks or four-inch brick-tiles on four-inch light beams, levelling up with the top of the twenty-inch beams. Since twenty-inch beams are long since rolled in England and Belgium, and probably much cheaper in Canada than in the United States, and tiles, if such be not made in Canada, can be imported via Cleveland, costing there about seven cents and ... cents respectively per square foot, this construction will at once be most solid and stiff, fairly moderate in price and not only non-burning, but strictly fire-proof. Instead of arranging a flat ceiling the beams can be shown and covered with tile and ornamental ... ing to suit any design. Yours truly, Carl Seiffert.

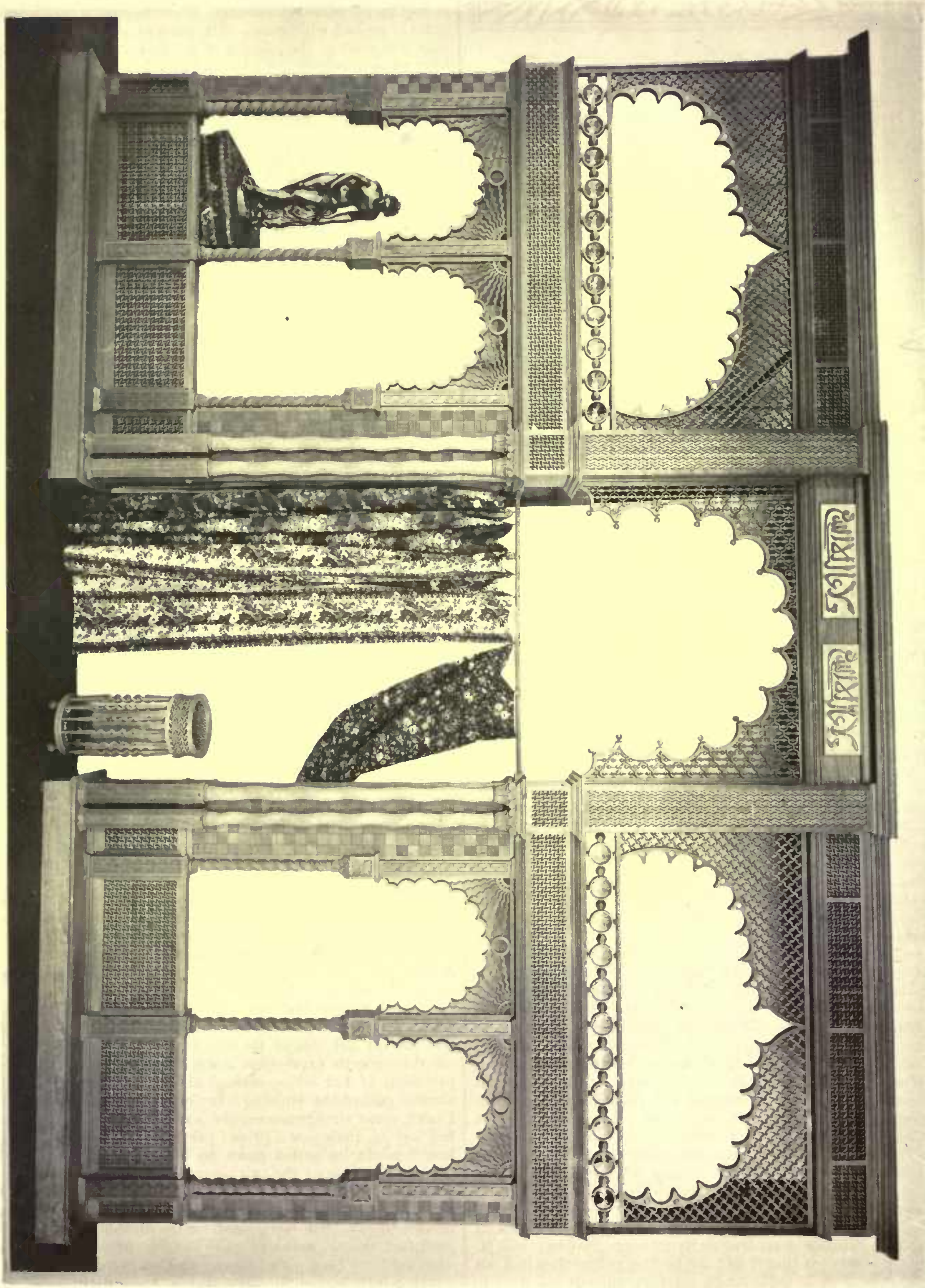
NOTES AND CLIPPINGS

The Trade-unions of England. — By order of the House of Commons Messrs. Hansard have just printed an appendix to the returns of the Chief Registrar of Friendly Societies for the year ending December 1885, giving a list of registered trade-unions in the United Kingdom, with the dates of their establishment, and, in some cases, particulars of their funds, incomes, and membership. From this it appears that the oldest of all the trade-unions in the kingdom is the Steam-Engine Makers' Society, Manchester, which was established on November 1824, and has now £10,435 accumulated funds, an annual income of £1,336, and a membership of 5,062. The union possessing the largest fund of those which have sent in returns (though it must be remembered that several of the largest societies, such, for example, as the Amalgamated Society of Engineers, have given no particulars of their finances) is the Amalgamated Society of Carpenters and Joiners, with headquarters at Manchester. The funds of this organization are stated at £50,851; annual income £63,122; and membership 25,781: it is, however, closely pressed by the Amalgamated Society of Railway Servants of England, Ireland, Scotland and Wales, whose headquarters are in City Road, London. The funds of this society are stated at £50,789, with an annual income of £14,375 and 9,054 members. The largest annual income — £70,704 — is claimed by the United Society of Boiler-makers and Iron Ship-builders of Newcastle-on-Tyne, with 27,695 members and accumulated funds amounting to £38,317. The Durham Miners' Association appears to be, so far as the returns show, numerically the strongest union in the kingdom, having 35,000 members, with an income of £46,153, and funds amounting to £35,993. Some of the titles of these societies show the extensive ramifications of trades-unionism. That there is a Warehousemen's Philanthropic Society in Bradford should occasion no surprise, but the same town boasts of a Stuff-makers-up Provident Society with considerable funds, and an income of more than £1,000 a year. The card-setting machine tenters, drillers and cutters of the "River Wear," Dutch yeast importers, trimmers and teemers, crabbers and singers, silk-ballers, potters' mould-makers, boot-top cutters, hammermen, tin-canister makers, carriage-straighteners, tape-sizers, chippers and drillers, brass-cock finishers, the amalgamated chimney-sweeps, the amicable wool-staplers, and the rundlet coopers — all these and many more have separate trade organizations of their own for mutual protection. Women, too, have learned the utility of combination, as may be gathered from the titles of the Westminster and Pimlico Branch of the London Tailoresses Trade-union, and the Rochdale Male and Female Card and Blowing-room Operatives' Association. In Sunderland there is a Shipyard Helpers' Association, and Birkenhead possesses the distinction of being the headquarters of the United Society of Holders-up of Great Britain and Ireland, which has 317 members, an annual income of £355, and £275 funded. — *London Standard.*

TRADE SURVEYS

Financiers who have been obliged for a few years past to put up with legitimate investments and margins, are just now, between midwinter and spring, watching the course of every channel of trade with unusual interest. Of all men, they have the least to say, but they are the closest observers. They are measuring possibilities. The facts and tendencies before them may be summarized as follows: There is an enormous absorption of capital in railroad construction, in manufactures and in house-construction companies. Firms and corporations are springing up by the hundred, investing what ready cash they can command and borrowing in many cases. Enterprise has been let loose, and production is being expanded, and capacity enlarged, and facilities of every kind multiplied. The opportunities for capital are being taken advantage of everywhere. Profits are sure though not so great as to attract it too freely. Money has been and is cheap, but how long, asks the financier, will it continue so. Are not the business interests of the country becoming heavily indebted to the money-lenders? Will not money soon be worth double its present rate? Will not this great absorption of capital increase its value and hence demand? Can we continue to invest $250,000,000 a year in railroad building, and more than as much more in house and shop building, to say nothing of the enormous sums in the endless outlays in other directions without discovering an inequality between the supply of and demand for money? And, when money becomes scarce and interest high will not values decline and property depreciate? Cannot all the financiers see the drift of things and be ready when the storm comes to buy up for a song the accumulations of industry for a decade? They are asking themselves these questions and counting probabilities. It is, therefore, well for those who are to suffer when these results happen, to give heed to the inquiry. Is there any immediate danger, immediate within one or two years? So far, not the least calculation has been made for a storm. Nor could it be expected of a people that they should do so when beset with demand for the products of forge, loom, and reaper, with an urgency seldom witnessed; nor yet should there be any occasion for care with the world half fed. The relations between a larger or smaller volume of money as distinguished from capital and the greater or lesser prosperity of a people have never been satisfactorily established, but the money-lending interests recognize that, at the present rate of absorption they will have, in the not remote future, a chance to accumulate rapidly. Yet the financiers may this time reckon without their host, the people and their energy and inventiveness of means to escape threatened ills. The plain facts are — business is rapidly expanding, and that the probable extensions and new constructions will surpass all former experiences. If the country is not wise enough to recognize and, at the proper time, apply the proper remedies and safe-guards, then, as individuals, we must suffer in common with all others. Fortunately, however, there are a few little indications that a conservative feeling is gaining control in trade. Where extremely high prices have been asked buyers have retired from the market. Where reasonable advances have been made buyers have liberally purchased. The great bulk of business now in hands of manufacturers of all kinds is covered by contracts of raw material. The railroad-builders have 1,200,000 miles of rails bought. The railway managers have orders out for locomotive-cars, etc. Mill owners have requirements covered all along the line down to the shopmen. Hence the danger of an overpowering demand has been greatly reduced. The downward tendency in agricultural products and the upward tendency in manufactured products must soon equalize themselves. Stocks are active in all markets because speculation on a large scale is impossible under our well-organized industrial system. The inducements to extend manufacturing are strong enough to guarantee us against idle capital or enterprise. Yet, at our present progress the stringency must come unless checked by conservative action of producers and transporters.

Within a few days buyers have disappeared from several markets on account of high prices. Large consuming interests are waiting, hoping to purchase at November or December prices. In lumber, coal, textiles, hardware, the spring prices will be very little different from last autumn's prices. In other directions there will be differences of 10 to 25 per cent. The nail-makers have regained control of the market. The Eastern bar-iron makers find their last week's advance easily maintained. The anthracite-coal producers have renewed this understanding, and the bituminous interests have formed a pool and fixed percentages. Demand is active both East and West. In building material prices remain steady. Lumber will decline in Atlantic markets by the opening of spring. Nails will also likely weaken, although manufacturers predict a further advance. Machinery building will engage more labor as the season progresses. The architects in Eastern cities are becoming quite busy on spring work, and in Western cities encouraging expectations are entertained as to the coming year's work. The tool-makers and the leaders in a multitude of small industries employing from 10 to 50 men are receiving a great deal of fresh work, which is a sort of reflected industrial activity from the larger industrial concerns. Mining machinery is in great request, and bridge and boat work will crowd the shop and yard capacity.



A SCREEN OF MOORISH FRET WORK

Executed by C. S. Ransom & Co., Cleveland, O.

Designed by J. H. Dunn.

HELIOTYPE PRINTING CO., BOSTON.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, TICKNOR & COMPANY, Boston, Mass. No. 580

FEBRUARY 5, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

M. RIVOALEN, in *La Semaine des Constructeurs*, calls attention to a new danger which threatens architects here, perhaps nearly as much as it does in France. It is curious that the course of the insurance business abroad has been very similar to that which it has followed here. Twenty years ago, the existing companies were doing a large business, and found themselves making great profits. It was not long before professional speculators also discovered this, and a swarm of new companies sprang up, with names, as M. Rivoalen says, "almost angelic" in the sense of security which they conveyed, and long lists of distinguished directors, ready to compete with the older corporations for the business and the profits. To introduce themselves, the new-comers wrote policies on anything and everything, receiving their premiums with the sweetest smiles, and paying generously for small partial losses. By these means they drew clients from the strong companies, who, to meet the competition, were obliged to make concessions, and incur risks, which gradually devoured the profits of their business, leaving them struggling from year to year for bare existence. The speculative companies, who went far beyond their older rivals in tempting fortune, would soon have succumbed, but for a novel feature which they introduced into their operations. Previously it had been customary, on satisfactory proof of loss, to pay the policy-holder his claim in full; but the new men, on being presented with notice of the total destruction of property which they had insured, lost their suave demeanor, denied and defied the claims of the policy-holder, finally consenting to pay a third or a fourth of the loss, but protesting that they would exhaust their whole capital, and the lives of all the parties concerned, in litigation, before they would pay another penny. The timid policy-holders, scared by these violent expressions, which are only too familiar here, usually compromised their claims, and the business of the new companies flourished, to the satisfaction of the speculators, if not of the stockholders, for a good many years. At last some of their policy-holders, less tractable than the rest, undertook to enforce their contracts of indemnity in full, by legal means, and succeeded; and this emboldened the rest, so that compromising became more difficult, and as their funds began to be drawn out more freely, the upstart companies fell ill, and died, one after another. Within a year or two, many of them have been swept away, and in France, as here, the old and strong companies, relieved of their unscrupulous competition, have become more careful about the risks which they take, and more particular in establishing rates to correspond with the real hazard. Besides this, they have taken to examining the effects of fire on various sorts of construction, and to noticing the defects which give occasion most frequently to conflagrations; and M. Rivoalen points out that it will not be long before they find out the dangers of those faults which careful architects endeavor to avoid, and nothing is more likely than that they may give considerable trouble to careless architects, who should have avoided the conditions which may have led to a fire, but neglected to do so. It must be remembered that an insurance company which pays a loss, acquires all the rights which the policy-holder would have, in collecting indemnity or damages from persons whose fault or negligence caused that loss, and, while a private owner would not usually think it worth while to inquire by whose carelessness a steam-pipe was allowed to come in contact with wood, or a smoke-pipe to be placed too near the ceiling, the officers of an insurance company would have no such reluctance, but would think it only their duty to their stockholders to pursue the person at fault to the uttermost. It is true that for the present it is no part of the architect's duty, unless his client wishes it, to depart from the usual system of construction in favor of one more secure against fire: and he cannot be blamed, still less held responsible, because the cheap roof, or the wooden furrings, which the exigencies of the case, including that of economy, required, proved less incombustible than the underwriters would have liked, but there are certain details, especially in city buildings, in which the law, not his client, gives him the directions that he must obey, and he can unquestionably be held responsible, to the extent of his property, for losses plainly due to his neglect of these directions. How enormous the losses may be for which he would be called upon to pay, we, in this easy-going country, hardly understand, but it is usual in France, if a fire spreads beyond the place where it originated, for all the neighbors injured by it to demand satisfaction from the original sufferer, and his policy generally expressly insures him against these claims; and it has been repeatedly decided in this country, we believe, that the person responsible for the first fire is liable, also, for the damage to all buildings or property to which fire may have been communicated from the first building.

THOSE architects who have had much to do with party-walls know that there are some inconveniences as well advantages, connected with the system of allowing one wall to serve for two owners. The inconveniences of the system are perhaps usually most conspicuously exhibited when one owner wishes to improve his property, and build upon the party-wall, which he is very apt to find in a condition quite satisfactory to his neighbor, but entirely unsuitable for his own purposes; and the opposing interests of the proprietor who wishes to pull it down and rebuild, and the one who prefers to leave it untouched, or, at least, not to pay anything toward the cost of reconstruction, often lead to serious quarrels. It is notorious that juries, when these quarrels are brought into court, usually incline toward the side of the party who objects to having the existing state of things disturbed; but the most extraordinary case of the kind that we have yet met with was decided without a jury in a French court. According to M. Collet-Corbinière's report in *La Semaine des Constructeurs*, a certain M. Meunier owned a vacant lot in Paris, adjoining a house belonging to Mme. André, the wall of which stood on the party-line. M. Meunier wished to build on his lot, using the party-wall, but was deterred from doing so by observing that the wall leaned in a manner which, to use the mildest expression, should be termed frightful. He sent an expert to examine the work, who reported that he found the masonry in so bad a condition that he had not dared to test the joints, or to detach any of the plastering, for fear of bringing the whole down about his ears, but he had ascertained that the top of the wall overhung the base nearly five feet. Luckily for Mme. André, it had chosen to lean toward her side of the line rather than the other, and to use the expert's expression, it was reposing on the floors and partitions of her house, instead of holding them up, and had already pushed the building over onto the next owner's land. Under these circumstances, the expert thought that the wall had lost its quality as a proper party-wall, and that, under the law, it might be pulled down by M. Meunier, and rebuilt at the joint expense of the two proprietors, and it was torn down and rebuilt accordingly. Mme. André's share of the bill amounted to thirty-two hundred dollars, which she absolutely refused to pay. On being sued for the amount, the counsel argued that the old wall was quite suitable for a party-wall, and need not have been pulled down; and, on being asked whether a wall which leaned fifty-five inches from the vertical, in a height of eighty-five feet, could be considered in good condition, coolly replied that this appeared to have been the result of design on the part of the original builders, and not of any weakness of the masonry. The expert, in opposition to this original

explanation, showed that the custom of Paris, which was the common law governing such cases at the time the house was built, before it was superseded by the Code Napoléon, expressly provided that any party-wall which, either accidentally or intentionally, leaned so much that the top overhung the base by a distance greater than half the thickness of the wall, should be considered as unfit for the purposes of a party-wall, and might be torn down and rebuilt by either owner at the joint expense. Notwithstanding these representations, the tribunal of first instance decided that Mme. André's wall was good enough for her purposes, and that she ought not to pay anything for having it rebuilt. The case was immediately appealed, and it seems likely that the higher court will reverse the decision; but it is worth remembering, in any case, that so authoritative a code as the Custom of Paris should have placed the limit between a serviceable and an unserviceable wall at the point where the variation from the vertical exceeded one-half the thickness of the wall.

FIRE AND WATER makes a suggestion which, in a somewhat amended form, would be an excellent one. It has just learned the fact, which has been known to architects and brick masons for about two hundred years, that in houses where wood is used for fuel, the "pyroligneous," or, as we should rather say, the crude acetic acid in the smoke, which is a very rapid solvent of lime, attacks the mortar in the joints of the brick chimneys, eating it away until it falls out, leaving an opening through which sparks escape, frequently setting fire to the woodwork near, and destroying the building. Moved by this discovery, with characteristic energy, it consulted a "building expert," who explained that "all the trouble would be done away with" by using terra-cotta chimney-caps above the roof, and carrying up round sheet-iron smoke-pipes from the various stoves and fireplaces, through the brick flues, to the top. The expert went on to say, what is undoubtedly true, that the circular iron pipe would carry off smoke better than the brick flue, and that the surrounding air-space might be used for ventilation, or for conducting air, heated by contact with the iron pipe, to the upper rooms; but he neglected to mention that, as pyroligneous acid has nearly as much fondness for sheet-iron as for lime, the pipe would be eaten away by the smoke in two or three years, and would fall in pieces down the flue, choking it up and giving infinite trouble, while the pyroligneous acid, with appetite only sharpened by the trifling postponement of its repast, was devouring the mortar joints, now fully exposed to its influence, and probably all the more vulnerable from having been laid with the idea that the iron pipe would protect them. With the substitution, however, of fire-clay pipe for iron, the objections to *Fire and Water's* plan disappear, and it deserves to be recommended to all builders and house-owners. Such pipe, which is, as *Fire and Water* will probably be surprised to learn, very extensively used for the purpose to which it proposes to apply it, is unaffected by anything contained either in coal or wood smoke, and, if properly made and set in place, will last as long as the brick flue in which it is set; while it conducts smoke rapidly and easily, is readily cleaned, without fear of endangering the house by the dragging of loose mortar out of the joints, which so often follows the sweeping of a brick flue, and if well put up, permits the use of the vacant parts of the chimney in which it is placed for ventilation or for the conveyance of hot air.

A CURIOUS little trick has been frequently practised of late in Paris, to the detriment of the lime manufacturers of the suburban region, who have taken steps to call the attention of the Government to their grievance. Every one knows that the splendid works of Paris, as of many other continental cities, are in great part paid for out of the proceeds of the *octroi*, or duty upon provisions, building materials and certain other necessaries of life, which is collected with rather annoying thoroughness at all the gates and railway stations. The *octroi* duty on lime for building purposes is two dollars and forty cents a ton, and as lime is used in the city in enormous quantities, the duty upon it not only brings a very substantial sum into the city treasury, but forms an important item in the expenses of contractors, who have naturally exercised their wits a good deal to find some way of relieving themselves of a part of the burden. As it happens, the French lime used in Paris is usually employed in a powdered state, something as the New York masons use ground lime for mortar. Whether the French lime, like that used in New York, is slightly hydraulic, so that it will not slake well unless pulverized, we do not know, but it seems not improbable. However that may be, the lime-burners, in order to powder their product for the market as cheaply as possible, sprinkle water on the lumps as they come from the kiln, to the amount of one-third of their weight, partially slaking them, but making their reduction to the desired condition much easier. Mixed, in this way, with water, the lime is sent to Paris, and pays duty on its weight in this semi-hydrated condition. Certain ingenious dealers, however, observing that the tariff makes no distinction between hydrated and non-hydrated lime, have recently procured from quarries in Belgium a cheap quick lime, resembling our Eastern lump lime, which can be slaked at any time. This lime is brought in lumps to the canal basin of La Villette, and then pays duty by weight, just as the French lime does. Once past the *octroi*, the dealer adds thirty-three per cent of water from the canal to his boat-load of lime, and makes four tons of marketable powder out of his three tons of dutiable lime. But this is not all. Without unloading his boat, he proceeds through the canal to the exit basin of Aubervilliers, where he obtains a drawback certificate, setting forth the weight of his watered cargo, and authorizing him to import, free of duty, a quantity of lime equal to that which he has exported. It is obvious that a cargo which increases by one-third every time it passes through a short canal must be a profitable one. Supposing only six trips a week to be made with one small canal boat, the *octroi* paid at the start on a cargo of three hundred tons, would at the end of the first week, have been stretched to cover nearly seventeen hundred tons, at a saving to the owner, and a loss to the revenue, of considerably over three thousand dollars, and, with a certificate entitling him to import free of duty seventeen hundred tons more, to begin the next week's business with, the boat-owner's profit would, as any one fond of arithmetic can ascertain, soon reach gigantic proportions. If the Belgian lime were equal to the French, the public officials might, perhaps, look with complacency upon the geometrical progression which was taking place in the denominator of the fraction which represented the ratio of the actual to the nominal duties which they collected upon it, but it is said to be inferior, and, according to *La Semaine des Constructeurs*, a strong argument is made against its introduction on this ground.

WE do not very often have occasion to speak particularly of the illustrations which appear in our technical exchanges, but we ought not to pass silently by the appearance of such beautiful sketches as the two which are to be found in *La Semaine des Constructeurs* for December 25. The two sketches show portions of the same building, the new Hôtel de Ville, at Neuilly, but they are by different hands, one, showing a corner pavilion of the façade with its great dormer window and a part of the beautiful cornice which runs around the building, being by M. Noé, whose admirable style is here shown at its best, while the other, giving a fragment of the same cornice is by M. Rivoalen, and is perhaps the prettiest bit of pen-and-ink detail sketching that we remember, not even excepting M. Raguenet's effective work. We have always admired greatly Mr. Raffles Davison's soft, but forcible drawing, but Mr. Davison's forte does not, perhaps, lie in figure-drawing, and he could hardly have done full justice to Barrias's round, luscious sculpture, which M. Rivoalen has rendered with perfect success. Pen-and-ink sketching, as we have sometimes observed, is a thing which few French architects attempt; but Frenchmen usually contrive to do well whatever they undertake, and if there is any architect who thinks he can make a better sketch of detail than M. Rivoalen, we hope he will communicate with us immediately.

IN the same number of *La Semaine* we find notes of a number of important changes in the Ecole des Beaux-Arts, which will interest many of our readers. First among these comes the appointment of M. Monduit, to succeeded the late M. Brune, as professor of construction, M. Chevillard, the professor of perspective, is replaced by M. Julien; and M. Hiolle, the professor of modelling, is succeeded by M. Delaplanche. Several professors have had substitutes appointed for the year, as, for instance, M. Henzey, whose courses in archæology will be given by M. Homolle, one of the most distinguished archæologists of the day; and M. A. Lenoir, professor of the history of architecture, whose classes will be taken by M. Boitte.

EARLY SETTLER MEMORIALS.[1] — VI.

MEMORIALS AT CONCORD, MASS. — THE OLD MONUMENT.


Old Monument, Concord, Mass.

The first corner-stone of this monument was laid in 1823, in the square in the centre of the town, but for lack of funds nothing more was done until 1836, when the present structure was built on land given by Rev. Dr. Ripley. During this interim, the boys of the town utilized the corner-stone as the beginning of a monument which they erected in the space of one night. They covered the ground intended for the base of the monument, that was unoccupied by the corner-stone, with three large empty sugar-boxes. Upon these they erected four hogsheads, then four barrels, four half-barrels, four nail-kegs, and four snuff-kegs. On these they placed one hogshead, then a barrel, a half-barrel, a nail-keg, and a snuff-keg, and surmounted all with a two-gallon jug.

To assist those who wished to view from such a lofty height the historical surroundings, these zealous youths borrowed, tradition says "stole," a pair of stairs from a neighboring store, and placed them against the patriotic pile. They also contributed an appropriate inscription. But neither time nor fate smiled upon this enterprise, for the fire consumed it one fine morning as well as destroyed the corner-stone.

The present monument was designed by Solomon Willard, the architect of the Bunker Hill Monument. It is built of granite, and paid for by State aid, private and public subscription. Its height is about eighteen feet. The inscription, cut on a marble slab placed on the side of the die, is as follows:

HERE
ON THE 19TH OF APRIL
1775
WAS MADE
THE FIRST FORCIBLE RESISTANCE
TO BRITISH AGGRESSION
ON THE OPPOSITE BANK
STOOD THE AMERICAN MILITIA
HERE STOOD THE INVADING ARMY
AND ON THIS SPOT
THE FIRST OF THE ENEMY FELL
IN THE WAR OF THAT REVOLUTION
WHICH GAVE
INDEPENDENCE
IN THESE UNITED STATES
IN GRATITUDE TO GOD
AND
IN THE LOVE OF FREEDOM
THIS MONUMENT WAS ERECTED
A. D. 1836.

THE MINUTE-MAN MONUMENT.

This monument was dedicated on the 19th of April, 1875, on the occasion of the centennial celebration of the Concord fight. The statue was made by Mr. D. C. French, a sculptor of Concord. In an article on "Civic Monuments in New England," published in the *American Architect*, in 1881, we wrote as follows, concerning this statue: "No statue of a soldier that we remember in this country suggests so much of a soldier's readiness, duty and purpose as that of the Minute-Man, at Concord. This Colonial plow-boy springs to the call of a sudden occasion. The young sculptor who made it was also ready to meet the emergency of getting his work ready for a memorable ceremony. Both lacked the training of venerable warriors in their arts, but were equal to the spirit of the moment. It is this seizure of the spirit of the subject, combined with a sense of sculpture, that has made a general feeling of satisfaction towards this statue.

"The tendency of the composition of the Minute-Man is true; it is intended to mean something definite; it has a positive aim in seeking to illustrate a thrilling fact. The statue will retain its interest because of this merit, and also because of its suggestion of possibilities in the future efforts of the sculptor. The maturity of its character as a composition, and the sincerity of its execution, would make grand work. It was modelled before the sculptor was twenty-five years of age.

"Before this statue, as before those of Milmore, considering the favorable opportunities surrounding these sculptors, one involuntarily asks why they did not take more time, and do their work much better? Is it the fault of the sculptors, or of the public, that a statue should be made for erection on a certain day, month or year, when it ought to be known and understood that the best work that the sculptor can possibly do with ample time for study is really the only object to be seriously considered? We admire the Minute-Man, and the sailor on the Army and Navy Monument, not so much for what they are as for what they might have been. We should have admired them if they had been made of stuffed clothes, because there is an individuality in their composition worthy of the most serious and intelligent study. It is not necessary that an art idea in sculpture should be cast in bronze, or cut in stone to prove or demonstrate its place in art. What was there to prevent French studying several years in Paris among the only sculptors of the world, and then making his Minute-Man? The same question may be asked of Milmore. Both of them could then have made grand things. It is a possibility confirmed by too many evidences, that the average committee-man is not too susceptible of the importance of good sculpture, but is over-tenacious of his own notions. It is both possible and certain that there is some responsibility resting upon the artist. That the Minute-Man should be erected on the 19th of April, 1875, was a frivolous necessity in comparison with that of the sculptor's making — what he was well able to do, by taking more time — a thoroughly fine statue, one fit for a century, instead of a date. The existence of a work of art is the appeal to posterity; the circumstances attending its production or erection are soon forgotten. The time ought to come when the sculptor will insist upon the fullest convenience for the execution



of his productions, and committees upon contributing a well-considered work of art to history rather than to the interest of a ceremony."

The form of the pedestal is very bad. It shows neither art, good taste nor good stone-cutting. Either of several of the memorial stones would have been much better. It has, however, two merits, it is not too high, and the inscription is put on in the right place. It is inscribed as follows: —

"By the rude bridge that arched the flood,
Their flag to April's breeze unfurled,
Here once the embattled farmers stood,
And fired the shot heard round the world."

The precise cost of this memorial is not known. Mr. French made his model, and left it to the town to pay him what it saw fit. The bronze was made from ten cannon granted by Congress.

THE MEMORIAL STONES.

The citizens of Concord, Massachusetts, decided that the commemorative purpose of the two hundred and fiftieth anniversary of the incorporation of the town, could best be carried out by the erection of tablets in localities connected with the leading events in its Colonial and Revolutionary history. The celebration of the anniversary

[1] Continued from No. 575, page 5.

was purely a local one — a home-coming of Concordians — no organization outside of the town was invited to take part. An address was delivered by Judge Hoar, of Concord.

In order to raise the money to defray the expenses of the occasion, legislative consent was necessary, and was obtained by a resolve of the General Court authorizing the town to raise for the purpose the sum of one-tenth of one per cent of its valuation by taxation.



Seven tablets were accordingly erected. The first was placed on the Simon Willard farm. The old farm buildings on the Willard estate were occupied during a portion of the Revolution by Harvard College. The farm-house, burned down a number of years ago, had the dimensions and dignity of an old château. In the stone wall of the farm a handsome boulder has been set, into the face of which is sunk a panel bearing the following inscription:

On this Farm Dwelt
Simon Willard,
One of the Founders of Concord,
Who did Good Service for
Town and Colony
For More than Forty Years.

At Merriam's Corner the retreating British Regulars were attacked in force by the minute-men of Middlesex, and a sharp skirmish occurred. Here a boulder has been set bearing this inscription:

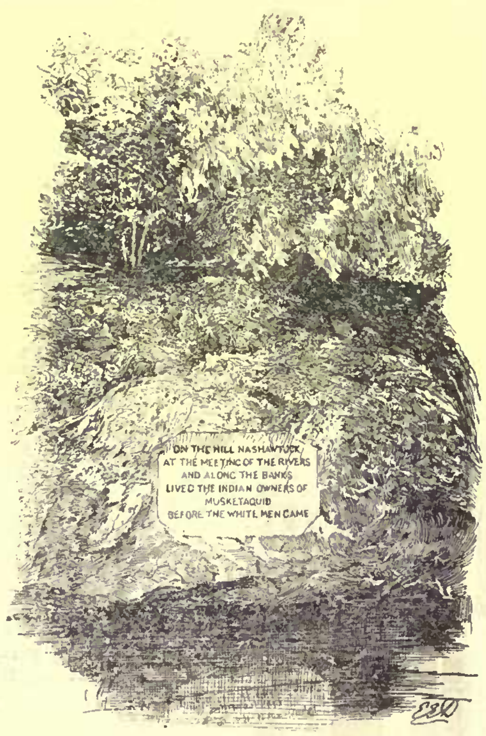


Stone Altar at Cledere.

MERRIAM'S CORNER.

The British Troop
Retreating from the
Old North Bridge
Were here attacked in Flank
By the Men of Concord
And Neighboring Towns
And Driven Under a Hot Fire
To Charlestown.

On the face of Egg Rock, the base of which is washed by the Sudbury River, a panel has been sunk, inscribed as follows:



On the Hill Nashawtuck
At the Meeting of the Rivers
And along the Banks
Lived the Indian owners of
Musketaquid
Before the White Men Came.

The site of the old town-house is marked by a tablet, stating that:

Near this Spot Stood
The First Town House
Used for
Town Meetings
And the County Courts
1721-1794.

On the hill where the Americans formed on the 19th of April, 1775, a slab is set in the stone-wall, with this inscription:

On this Field
The Minute-Men and Militia
Formed Before Marching
Down to the
Fight at the Bridge.

The site of Rev. Peter Bulkeley's house is marked by a bronze tablet inscribed:

Here in the House of the
Rev. Peter Bulkeley First Minister
and one of the
Founders of this Town
a Bargain was made with the
Squaw Sachem and Sagamore
Tahattawan
and other Indians
who then Sold their Right in
the Six Mile Square called Concord
to the English Planters
and gave them Peaceful Possession
of the Land
a. d. 1635.

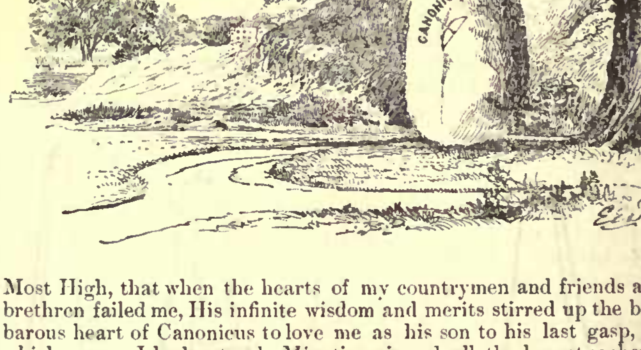
The old Hill Burying-ground is marked by a slate slab set into the wall, upon which is cut this inscription:

On this Hill the Settlers of Concord
Built their Meeting House
Near which They were Buried.
On the Southern Slope of the Road
were their Dwellings
During the First Winter.
Below it they Laid Out
Their First Road and on the Summit
stood the Liberty Pole of the
Revolution.

The good taste, in its widest sense, manifested by the committee who had in charge the erection of these tablets, needs no commendation. It appears that there are men in an American community who can be depended upon for good judgment, modesty, and an understanding of the subject with which they are dealing, in this very important matter of memorial monuments. These tablets become almost works of art, when examined in comparison with the monstrosities that desecrate so many towns and cities of the country. The committee on the erection of the tablets were Charles H. Walcott, Edward W. Emerson, Arthur G. Fuller, John F. Hosmer, and Wm. H. Hunt. Nothing better can be said of this committee than that they fully met the nature of the occasion. The seven tablets cost about eight hundred dollars.

CANONICUS BOULDER, PROVIDENCE, RHODE ISLAND.

Roger Williams wrote, more than two centuries ago, "I declare to posterity that, were it not for the favor God gave me with Canonicus, none of these parts, no, not Rhode Island, had been purchased or obtained, for I never got anything out of Canonicus but by gift. I desire posterity to see the gracious hand of the



Most High, that when the hearts of my countrymen and friends and brethren failed me, His infinite wisdom and merits stirred up the barbarous heart of Canonicus to love me as his son to his last gasp, by which means I had not only Miantinomi, and all the lowest sachems my friends, but Ousamequin also . . . . It was not price and money that could have purchased Rhode Island, but it was obtained by love."

Later appreciators of this Indian have also declared that, "To Canonicus and Miantinomi, Rhode Island owes more than to all others. They lived, and Rhode Island exists as a State to-day." "No man, not of our own race, deserves kindlier memories than Canonicus, the brave and humane old chief of the Narragansetts, savage

though he was, and surrounded as he was by the fierce and barbaric customs of his people. With thousands of followers ready and eager to obey any command, no matter how cruel, the old warrior refrained from destroying the little band of an alien race, who came seeking an asylum away from their own people. From what we know of this old Indian king, there does not appear a grander character in our Colonial history. . . . Without the aid of Canonicus, the experiment of civil government founded on religious as well as political freedom, would have been postponed perhaps for generations."



Gravestone of Professor Agassiz, Cambridge, Mass.

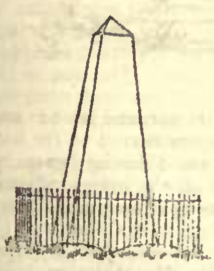
It has long been a favorite idea with some of the most earnest Rhode Island historical writers, to erect boulder memorials to distinguished Indian sachems, who have left an impress on Rhode Island history. An incident originating in very humble circumstances was the commencement of the realization of this idea. Some workmen in excavating for a sewer in Providence, brought to the surface a symmetrically-shaped boulder of primitive granite, which, before civilization had filled up the land, had evidently stood upon the bank of the stream. This stone falling under the observation of the Rev. Frederic Denison seemed to him especially adapted to memorial purposes, and, through his efforts mainly, and under the auspices of the Rhode Island Historical Society, it was placed in its present position as a memorial to the Narragansett chieftain. It stands in "Sachem's

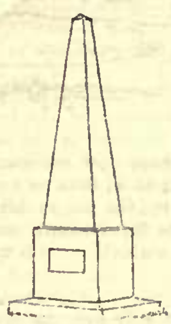

Gravestone of R. W. Emerson, Concord, Mass.

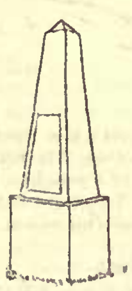

Pillar at Ellora, India.

Glen," in the North Burial Ground, Providence, R. I. It is about five feet high, and about two feet square, and bears upon it the name "Canonicus," with a rude bow and arrow beneath it. The bow and arrow were cut upon the stone for two reasons; first, because they were so thoroughly symbolical of an Indian, and especially of a Narragansett; and, secondly, because they were sometimes used by Canonicus when making his mark.

The boulder was dedicated September 21, 1883, with ceremonies


Harvard.


Humphreys.


Jefferson.

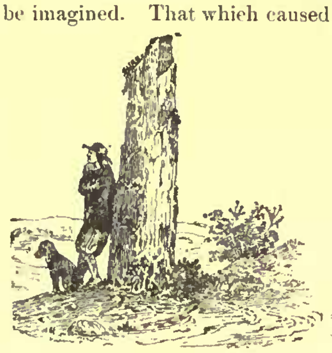

Webster.

usual on such occasions. It was unveiled by a member of the Narragansett tribe. Canonicus died June 4, 1747, at over eighty years of age.

The old monument at Concord, and those of Harvard, Humphreys, Jefferson and Webster, sufficiently illustrate the first upright monuments erected in the United States. The style of the first has been carried to a certain degree of development by the addition of mouldings, while the others have simply grown in size. As we make them, they have no value as works of art, nor any defined meaning with reference to the dead. Their symbolic object is claimed to be in accord with the unpretentious characters, lives, or professions of those to whom they are erected.

Boulders, or uncut blocks of stone, have been used by almost every nation, for sacred purposes of every description from time immemorial. Whatever may be the symbolic object of their erection, they stand with equal human grace and appropriateness as memorials to the poet, the philosopher, the priest or the savage. They are the purest emblems of simplicity of all monumental forms.

The motives of their erection are as widely different as could well be imagined. That which caused the placing of the one at the grave


Menlier at Grahesson.

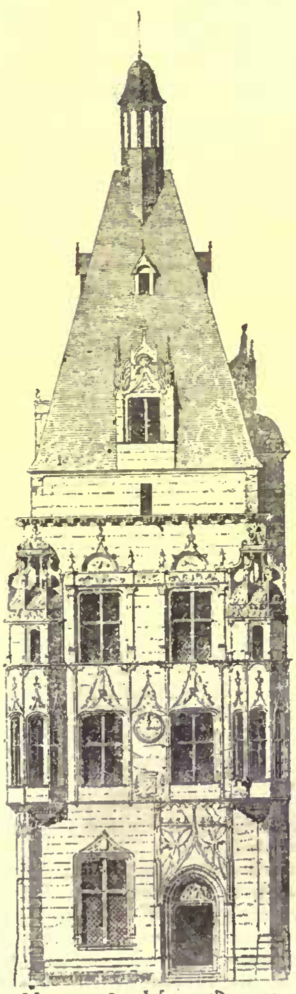

Menlier at Carnac.

of Emerson, and that which is set up to the memory of Canonicus, afford a good illustration. The first, a rock of massive beauty and variety of detailed surface; the second, a close-surfaced symmetrical boulder.

T. H. BARTLETT.

[To be continued.]

UNITED STATES GOVERNMENT BUILDING PRACTICE. — I.


HOTEL DE VILLE. DREUX.
FROM THE MONITEUR DES ARCHITECTES.

IN the articles which will be published under this heading, it is proposed to show the methods, at present in vogue, of erecting Government buildings: first, the legal conditions governing the commencement and prosecution of the work; second, the specifications; third, the system used in measuring and estimating the cost of building work; and fourth, prices and data for determining the same for the various materials and labor consumed in erecting buildings.

CHAPTER I.

The Supervising Architect has charge of purchasing sites and the construction of all buildings for custom-houses, court-houses, post-offices, marine-hospitals, mints, assay offices, appraisers' stores, and barge offices; the making of plant, specifications, and estimates for these buildings, and the proper arrangement and preservation of the same, together with all reports, correspondence, etc., in relation thereto; the general superintendence of the actual construction of the buildings; and the necessary repairs to completed buildings.

An appropriation for a Government building is generally obtained from Congress by the efforts of the citizens or members of Congress in whose district the city is, for which the appropriation is made; the limit of cost is fixed, by the opinions of those interested, as to how much will be needed to erect a building of sufficient size for the officials in that place, or by the amount they can succeed in getting the appropriations committee to recommend; it is seldom that the Supervising Architect makes plans and estimates for a building which he considers sufficient for the needs of the Government in that locality, before the appropriation is made.

Exhibit of actual Cost and Construction of U. S. Government Buildings.

City and Building.	Entire Building: No. of stories.	Cube contents.	Cost exclusive of heating, vaults, site, and app'chs.	Rate per cube foot.	Facing of Walls.[1]
Albany, N. Y. Custom-house and Post-office	B. 3 & A.	1,404,561	$610,743.00	43.5	Granite, cut ashlar, and moulded courses
Atlanta, Ga. Custom-house and Post-office	B. & 3	686,033	265,516.00	38.1	Pressed brick, cut-granite belt-courses and trimmings
Austin, Tex Court-house and Post-office	B. & 2	409,788	175,665.13	42.9	White sandstone, rubbed and moulded
Charleston, W. Va. Court-house, Post-office, etc.	B. & 2	303,200	72,870.50	24.	Pressed brick and rubbed limestone trimmings
Chicago, Ill. Custom-house	B. & 4	6,717,048	4,323,912.20	64.7	Buena Vista sandstone, rubbed and moulded
Cincinnati, O. Custom-house and Post-office	B. 4 & A.	7,883,474	4,925,726.45	62.5	Basement, red granite; superst., gray granite, cut and moulded
Cleveland, O. Custom-house, etc., extension	B. & 3	655,122	300,000.00	45.8	Sandstone, rubbed and moulded
Covington, Ky. Court-house and Post-office	B. 3 & A.	708,298	248,724.95	35.1	Sandstone, rock-face ashlar, rubbed quoins and moulded trims.
Danville, Va. Court-house and Post-office	B. 2 & A.	249,744	85,261.00	34.1	Pressed brick and terra-cotta trimmings
Dover, Del. Post-office, etc.	B. 1 & A.	136,045	49,660.45	36.5	Basement, stone; superstructure, pressed brick and stone trims.
Evansville, Ind. Custom-house, etc.	B. 2 & A.	615,492	219,850.27	35.7	Limestone, moulded trims., rock-face ashlar and granite columns.
Fall River, Mass. Custom-house and Post-office	B. & 3	703,828	346,542.04	49.2	Gray and red granite, rock-face ashlar and cut trimmings
Frankfort, Ky. Court-house, Post-office, etc.	B. 2 & A.	337,070	97,171.28	28.8	Bedford limestone, rubbed and moulded courses
Grand Rapids, Mich. Court-house and Post-office	B. & 3	524,424	126,717.09	24.2	Pressed brick and cut-stone cornices and trimmings
Harrisburg, Pa. Post-office, etc.	B. & 3	489,720	264,361.42	54.	Granite, cut ashlar and moulded courses
Hartford, Conn. Custom-house and Post-office	B. 3 & A.	811,204	811,021.76	1.00	" " " "
Jackson, Miss. Court-house, Post-office, etc.	B. & 3	311,545	101,150.35	32.4	Pressed brick, stone and terra-cotta trimmings
Jackson, Tenn. Court-house, Post-offic, etc.	B. 2 & A.	213,700	52,711.58	24.7	" " " "
Kansas City, Mo. Custom-house and Post-office	B. & 3	796,177	354,292.16	44.5	Warrensburgh sandstone, rubbed and moulded courses
Lincoln, Neb. Custom-house and Post-office	B. 3 & A.	445,291	178,823.65	40.2	Sandstone, rock-face ashlar, rubbed quoins and trimmings
Little Rock, Ark. Custom-house, Post-office, etc.	B. & 3	494,648	215,788.75	43.6	Sandstone, rubbed and moulded courses
Memphis, Tenn. Custom-house, etc.	B. & 3	808,370	510,967.15	63.2	Basement, granite; superstructure, marble, rubbed and mol'ed
" " Marine hospital	2	443,341	38,775.00	8.7	Two brick and four frame buildings
Montgomery, Ala. Custom-house, Post-office, etc.	B. & 3	506,295	142,000.00	28.	Pressed brick, stone and terra-cotta trimmings
Nashville, Tenn. Custom-house, etc.	B. 3 & A.	1,093,491	391,867.95	35.8	Limestone, rock-face ashlar, and rubbed and moulded trims
New Orleans, La. Marine hospital	2	749,849	58,395.90	7.8	Three brick and five frame buildings
New York. Barge office	B. 2 & A.	360,707	203,334.44	56.3	Granite, rock-face ashlar and cut trimmings
Paducah, Ky. Custom-house, Post-office, etc.	B. & 3	300,202	123,471.09	41.2	Limestone, rubbed and moulded courses
Parkersburg, W. Va. Custom-house, Post-office, etc.	B. 3 & A.	585,321	219,611.32	37.5	Pressed brick, limestone cornices and trimmings
Philadelphia, Pa. Custom-house and Post-office	B. & 4	7,378,820	4,314,842,66	58.5	Granite, cut and moulded courses
Poughkeepsie, N. Y. Post-office, etc.	B. 2 & A.	281,251	63,835.13	22.7	Pressed brick, stone and terra-cotta trimmings
Raleigh, N. C. Court-house and post-office	B. 3 & A.	590,646	329,685.23	55.8	Granite, cut and moulded courses
San Francisco, Cal. Appraisers' Stores	B. & 4	2,385,000	830,837.00	34.8	Brick and stone cornices and trimmings
St. Louis, Mo. Custom-house, etc.	Sub B.B. & 4	5,854,918	5,395,299.71	90.8	Basement, red granite; superstr., gray granite, cut and moulded
Topeka, Kan. Custom-house and Post-office	B. & 3	755,560	280,314.05	37.1	Limestone, rubbed and moulded courses
Trenton, N. J. Custom-house and Post-office	B. & 3	649,140	321,075.07	49.5	Amherst sandstone, rubbed and moulded courses
Utica, N. Y. Custom-house and Post-office	B. & 3	630,246	241,618.47	38.3	Basement, granite; superstr., sandstone, rubbed and mo'ld courses
Washington. Eng. and Printing Bureau	Sub B.B. & 3	1,989,316	310,615.10	15.6	Eng. and Prtg. Bureau. Pressed brick, stone and terra-cotta trims.

As soon as a site has been selected, suitable for the purpose for which the building is intended, plans for the proposed building are made to accommodate, so far as possible, the officials in that vicinity, in accordance with reports which have been previously asked for, as to the floor-space, etc., required for the respective offices.

It is required by law that the plans and a detailed estimate, for each building, within the appropriation, shall be approved by the Secretary of the Treasury, Postmaster-General and Secretary of the Interior, before work can be begun.

In order to determine how large a building can be erected for the amount of the appropriation available after the purchase of the site and attendant expenses, and thereby save the making of many plans until one is hit upon of proper size, the first thing to determine is the character of the building, whether of stone or brick, of iron or wood construction. From experience in computing and estimating it can be told very nearly how much per cubic foot a building of a certain size and character will cost, dividing the rate per cubic foot which it is judged the building will cost into the amount of money available for its erection, will determine how many cubic feet the building is to contain, after which the general length, breadth and height of the building can be determined.

In judging of the rate per cubic foot a building should cost, it must be borne in mind that the size of the building is a material factor, a small building costing more per cubic foot than a larger one of the same character; also that Government buildings have four finished fronts, and that buildings with any of the fronts unfinished, or of cheaper construction, will, therefore, cost proportionally less.

In measuring the cubic contents of a building the actual volume is to be taken from the outside of all walls, and from the bottom of the foundations to the top of the roof, including all areas, steps and foundations, towers, dormers and chimneys; proper allowance or deduction must be made for the slope of the roof, as only the actual volume from the outside of all surfaces which enclose the building should be taken. Cornices and projecting courses are immaterial and are not considered in this measurement.

Accompanying this article is a table giving the actual cost per cubic foot, etc., of thirty-eight buildings constructed by the Government, which will be found to be a fair guide for buildings of the same character and construction. After the size of the building has been determined the plans are prepared for approval in accordance with the design determined by the Supervising Architect, which plans consist of at least two elevations and floor plans, to a small scale ($\frac{1}{8}$ inch or $\frac{1}{16}$ inch to a foot), of all the stories showing the arrangement and sizes of the rooms for the several offices. A detailed estimate is then made of the cost of each branch of work for the building, with a general specification, giving the materials, etc., of which it is to be constructed in accordance with the estimate.

A synopsis giving the estimated cost for each branch of work, and the plans are then submitted by the Supervising Architect to the three cabinet officers before mentioned for approval, after which no material change can be made without subsequent approval.

The general system of measuring and estimating for each trade will be given in future chapters with the specifications in detail.

After the plans and estimate are approved the working-drawings and specifications for each trade are prepared, the work advertised and the contract usually awarded to the lowest responsible bidder in the order in which a building is usually erected, excavating, foundations, stone and brick work, and so on. Sometimes when the building is small the contract is made for the entire work complete.

The law requires all work to be advertised, and the award of contracts is made by the Supervising Architect, after approval by the Secretary of the Treasury. Where the work would be delayed by advertising the Supervising Architect must declare that an emergency exists requiring the immediate performance of the work, when bids may be invited therefor by circular letters, or parties may be employed to do the work by the day, which action must also have the approval of the Secretary of the Treasury.

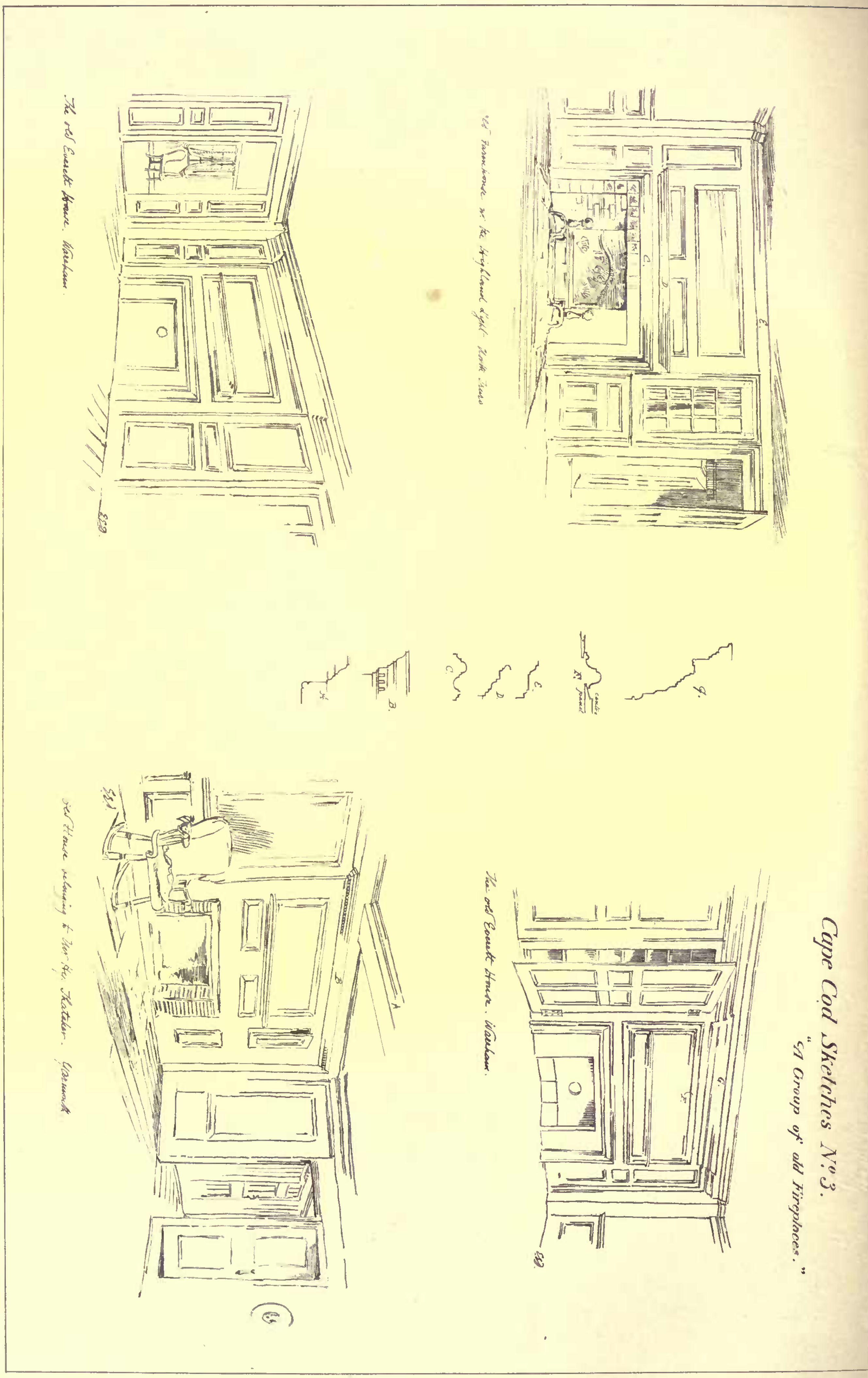
In the foregoing table the high rate per cubic foot for entire building at Chicago, Cincinnati and Philadelphia is because the stone was cut under the old fifteen per cent contracts, when it was to the interest of the contractor and his workmen to spend as much time as possible in cutting stone. The rate for the Hartford building is high for the same reason, and because of two large granite towers, and the unusual plan and arrangement of the building. The rate of the St. Louis building is high because of the fifteen per cent contracts for granite, and also because the building is surrounded by area walls about twenty-five feet high, built of red granite.

The rate per cubic foot for the Engraving and Printing Bureau at Washington is low because the building has few interior walls and very plain interior finish, the ceilings, except in a few rooms, being unplastered.

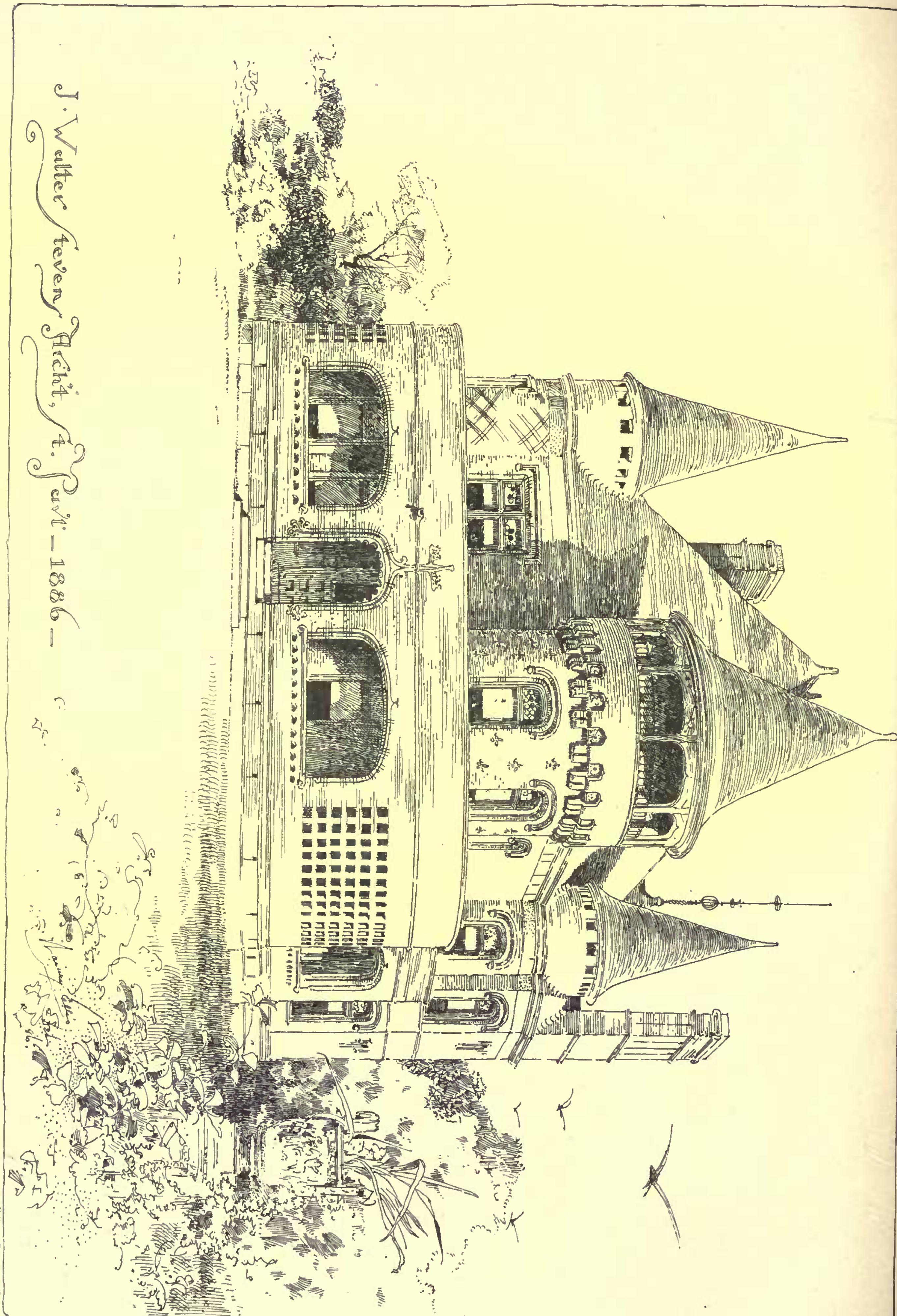
In the column under Heating Apparatus, the rate per cubis foot is for heated space, which will average about fifty-three per cent of the entire cubic contents of the building and does not exceed sixty per cent of entire cubic contents in any instance.

Jas. E. Blackwell.

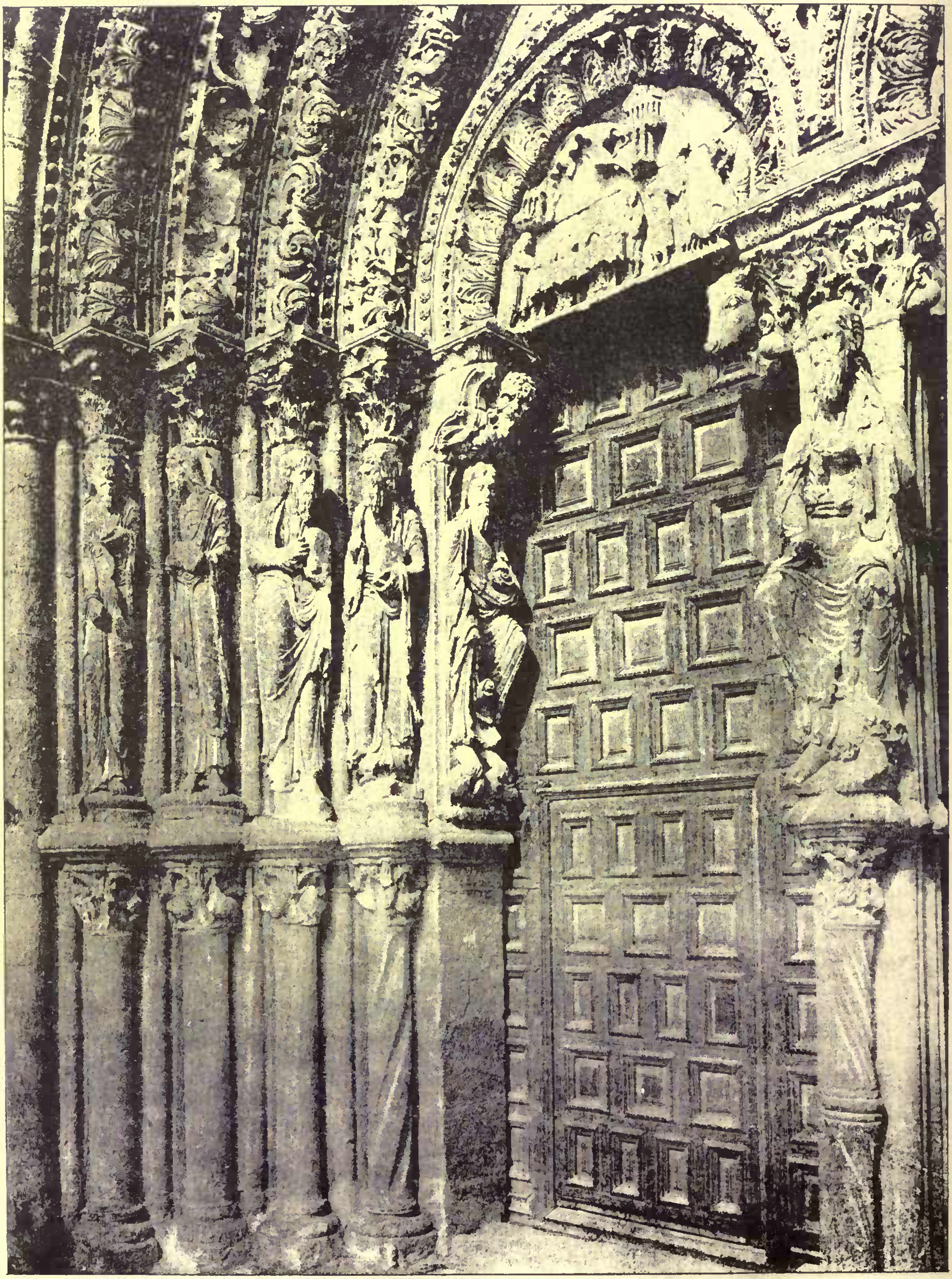
[1] All interior walls and the backing of all exterior walls of superstructures are built of brick, the stone facing averaging 8″ and 12″ beds alternating. The backing of exterior basement walls are sometimes built of rubble stone when the cost does not exceed what brick would cost.



Heliotype Printing Co. Boston.



Heliotype Printing Co. Boston



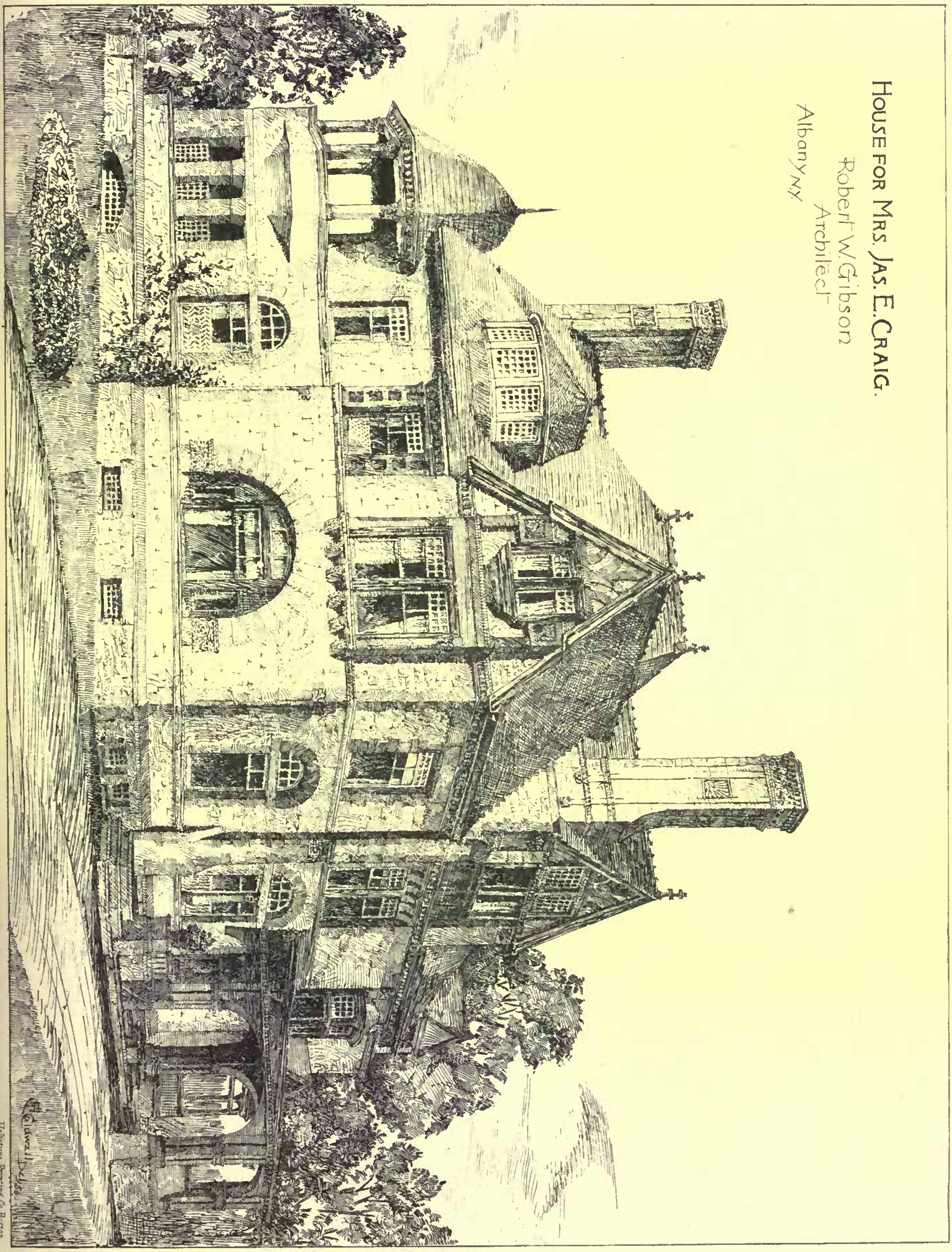
Heliotype Printing Co. Boston

Doorway of the Church of St. Vincent, Avila, Spain.



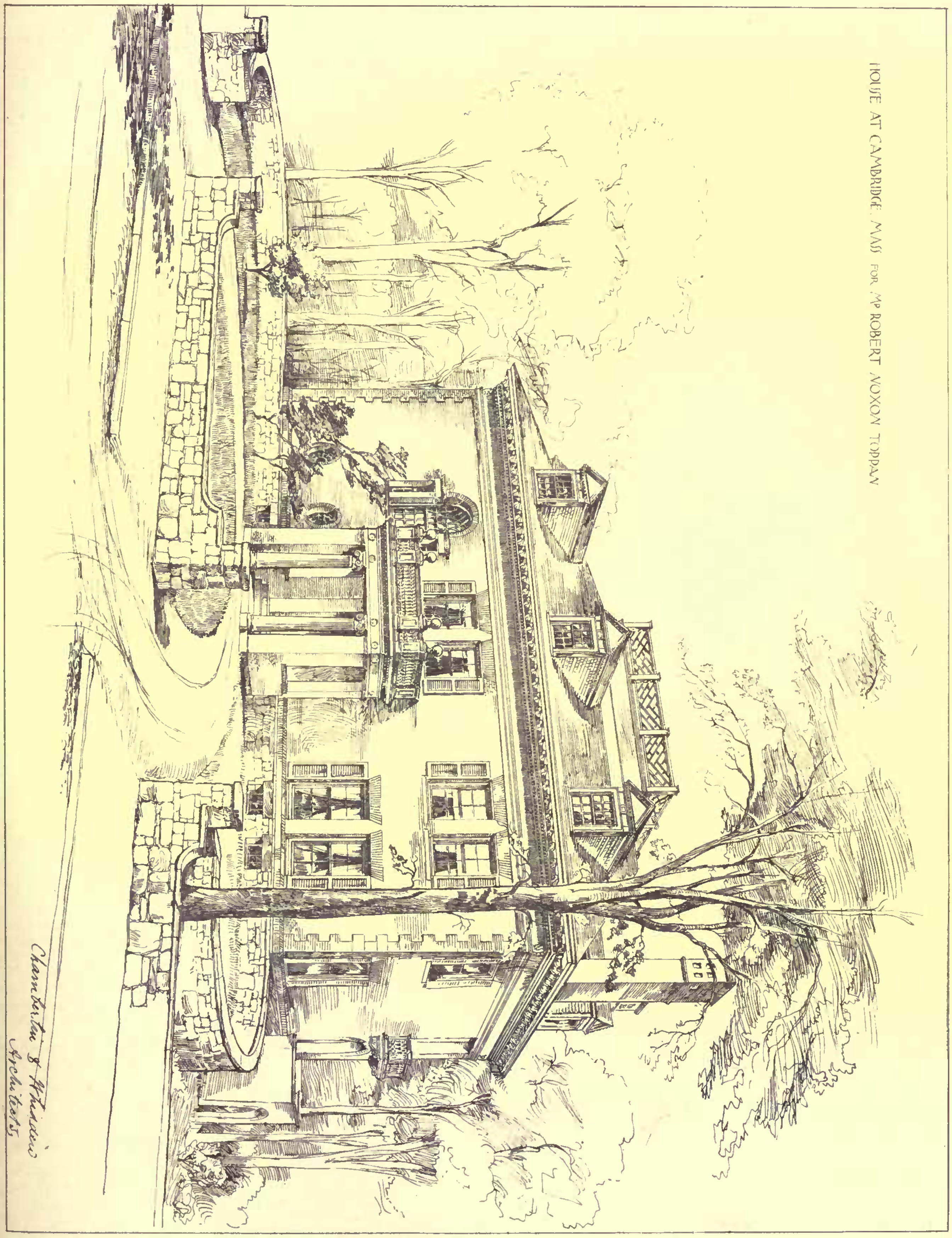
Heliotype Printing Co. Boston

STORES ON SOUTH STREET BOSTON, MASS. *Chamberlin and Whidden, Architects, 6 Beacon St. Boston.*



HOUSE FOR MRS. JAS. E. CRAIG.
Robert W. Gibson
Architect
Albany, N.Y.

Heliotype Printing Co. Boston.



HOUSE AT CAMBRIDGE, MASS FOR Mr ROBERT NOXON TOPPAN

Heliotype Printing Co. Boston.

EXHIBIT OF ACTUAL COST AND CONSTRUCTION OF U. S. GOVERNMENT BUILDINGS.

Floors.	Roof.	Interior Finish.	Heating Apparatus.			
			Kind.	Cost.	Cubic feet of heated space.	Rate per cube foot.
Iron beams and brick arches	Iron, slate and copper	White oak, 2 iron stairs	Steam.	18,543.00	678,060	2.7
" " "	" " "	Butternut, 1 iron stair	H. W.	7,448.00	395,998	1.9
I-beams, brick and iron arching	Iron trusses, wood, slate and copper	Florida pine, 2 iron stairs	F'n'ce.			
1st floor, I-beams and brick arches; others wood	Wood and slate	Pine, 1 wood stair	H. W.	7,948.00	151,865	5.2
Iron beams and arches	Iron, slate and copper	Iron and mahogany, 2 iron stairs	H. W.	120,929.36	3,915,912	3.1
Iron beams and brick arches	" " "	" " " "	H. W.	139,648.75	4,158,057	3.4
" " "	Iron and slate	Oak, and 2 iron stairs	H. W.	31,848.00	660,646	4.8
1st and 2d floors, I-beams and arches; others wood	Wood, slate and copper	Butternut, 1 iron stair	H. W.	6,892,50	367,542	1.9
1st floor, I-beams and brick arches; others wood	" " "	White pine, 1 wood stair	H. W.	6,648.00	117,528	5.6
" " " "	" " "	Ash, and 1 wood stair	H. W.	1,548.00	66,856	2.3
I-beams and terra-cotta arches	" " "	Butternut, 1 iron stair	H. W.	6,888.00	241,604	2.9
1st and 2d floors, I-beams and brick arches; others wood	Wood, slate and asphalt	" " "	H. W.	11,900.00	313,080	3.8
Iron beams and brick arches	Wood, slate and copper	Pine and oak, 1 wood stair	H. W.	5,995.00	167,000	3.6
1st and 2d floors, I-beams and brick arches; attic, wood	Wood and slate	Butternut, and 1 wood stair	H. W.	6,448.00	243,467	2.6
Iron beams and arching	Iron, slate and copper	Oak, 2 iron stairs	H. W.	17,309.35	266,973	6.5
" "	" " "	Butternut, 1 iron stair	Steam.	10,638.35	380,683	2.8
Wood, joists and double floor	Wood and copper	Pine, and 1 wood stair	H. W.	6,464.00	142,000	4.5
" " "	Wood, slate and copper	" " "	H. W.	4,285.00	105,000	4.
Iron beams and arching	Iron, slate and copper	Pine and oak, 2 iron stairs	Steam.	15,735.00	368,984	4.3
" "	Wood, slate and copper	Ash, 1 iron stair	H. W.	6,548.00	248,961	2.6
" "	Iron, slate and copper	Cypress, 2 iron stairs	H. W.	8,848.00	288,874	3.
" "	" " "	Pine and cherry, 1 iron stair	H. W.	14,152.00	411,274	3.4
Wood joists	Wood, slate and tin	Pine, and 1 wood stair	Steam.	3,091.00	153,605	2.
Wood joists and double flooring	" " "	Pine, oak, and 1 wood stair	H. W.	7,848.00	254,770	3.1
Iron beams and arching	Iron, slate and copper	Pine and cherry, 2 iron stairs	H. W.	19,414.00	555,123	3.5
Wood joists	Wood, slate and tin	Pine, and 1 wood stair				
Iron beams and arching	Iron, slate and copper	White pine, 2 iron stairs	Steam.	6,448.00	130,146	4.9
1st floor, I-beams; others, oak joists	Wood, slate and copper	White pine, and 1 wood stair	H. W.	7,948.00	151,238	5.3
Iron beams and arching	" " "	White oak, 1 iron stair	H. W.	7,588.00	313,829	2.4
Iron beams and brick arching	Iron, slate and copper	Iron and mahogany, 2 iron stairs	Steam.	120,050.85	4,036,622	3.
Wood joists and double flooring	Wood, slate and copper	Pine, and 1 wood stair	Steam.	3,441.00	124,334	2.7
Iron beams and arching	" " "	Pine, 1 iron stair	H. W.	6,600.00	293,773	2.3
" "	Iron, slate and copper	Red wood and pine, 2 iron stairs				
Iron beams and brick arching	" " "	Iron and mahogony, 2 iron stairs	H. W.	156,047.36	3,012,856	5.2
" " "	" " "	Mahogany, 1 iron stair	Steam.	13,479.00	388,318	3.5
Iron beams and arching	" " "	Ash, 2 iron stairs	H. W.	6,988.00	323,971	2.2
" "	" " "	Oak, 1 iron stair	H. W.	13,448.00	341,375	3.9
" "	" " "	Pine, 1 iron stair	Steam.	19,173.50	1,080,446	1.8

THE ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

READING-ROOM, MISSOURI SAFE-DEPOSIT COMPANY, EQUITABLE BUILDING, ST. LOUIS, MO. MESSRS. THAYER & ROBINSON, ARCHITECTS, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial Edition.]

THIS room is one of a suite of offices in the basement of the Equitable Building as lately altered and fitted up for the business of a safe-deposit company. The conditions were exceedingly circumscribed, owing to the low story and constructive requirements in the substructure. The vaulted ceiling was introduced with a view to forming a unit of what were originally three independent offices where the dividing walls could be but partially removed. The wainscot is executed in oak, in five thicknesses, cross and counter veneered — the shafts of pilasters in arched openings being of St. Anne marble with capitals of bronze, while the mantel is of Boise d'Orient marble and tiling of Tennessee marble. The vaulted ceiling is of iron, plastered with decorations in distemper.

HOUSE OF R. N. TOPPAN, ESQ., CAMBRIDGE, MASS. MESSRS. CHAMBERLIN & WHIDDEN, ARCHITECTS, BOSTON, MASS.

THIS house is built of common brick laid in white mortar, with quoins of pressed brick laid in red mortar. The cornice and other wooden finish are painted white.

STORES ON SOUTH STREET, BOSTON, MASS. MESSRS. CHAMBERLIN & WHIDDEN, ARCHITECTS, BOSTON, MASS.

HOUSE FOR MRS. J. E. CRAIG, ALBANY, N. Y. MR. R. W. GIBSON, ARCHITECT, ALBANY, N. Y.

THE house was built on Englewood Place, in this city, and cost about $25,000.

HOUSE AT ST. PAUL, MINN. MR. J. W. STEVENS, ARCHITECT, ST. PAUL, MINN.

SIDE DOORWAY OF THE CHURCH OF SAN VINCENTE, AVILA, SPAIN.

CAPE COD SKETCHES NO. 3.

SAFE BUILDING.—XII.[1]

CHAPTER II.

FOUNDATIONS.

Nature of Soils. THE nature of the soils usually met with on building sites are: rock, gravel, sand, clay, loamy earth, "made" ground and marsh (soft wet soil).

If the soil is hard and *practically* non-compressible, it is a good foundation and needs no treatment; otherwise it must be carefully prepared to resist the weight to be superimposed.

Stepping Courses. The base-courses of all foundation walls must be spread (or stepped out) sufficiently to so distribute the weight that there may be no appreciable settlement (compression) in the soil.

Two important laws must be observed: —

1. All base-courses must be so proportioned as to produce exactly the same pressure per square inch on the soil under all parts of building where the soil is the same. Where in the same building we meet with different kinds of soils, the base-courses must be so proportioned as to produce the same relative pressure per square inch on the different soils, as will produce an equal settlement (compression) in each.

2. Whenever possible, the base-course should be so spread that its neutral axis will correspond with the neutral axis of the superimposed weight; otherwise there will be danger of the foundation walls settling unevenly and tipping the walls above, producing unsightly or even dangerous cracks.

Example.

In a church the gable wall is 1' 6" thick, and is loaded (including weight of all walls, floors and roofs coming on same) at the rate of 52 *lbs. per square inch. The small piers are* 12" x 12" *and 7' high, and carry a floor space equal to* 12' x 20'. *What should be the size of base-courses, it being assumed that the soil will safely stand a pressure of* 30 *lbs. per square inch?*

If we were to consider the wall only, we should have the total pressure on the soil per running inch of wall, 18.52 = 936 lbs.

Dividing this by 30 lbs., the safe pressure, we should need $\frac{936}{30} =$ 31.2" or say 32" width of foundation, or we should step out *each side* of foundation wall an amount $\frac{32-18}{2} = 7''$ each side.

Now the load on pier, assuming the floor at 100 lbs. per square foot, would be 12 × 20 × 100 = 24,000 lbs. To this must be added

[1] Continued from page 8, No. 575.

the weight of the pier itself. There are 7 cubic feet of brickwork (weighing 112 pounds per foot) = 7.112 = 784 lbs., or a total load of say 25,000 lbs. This is distributed over an average of 144 square inches; therefore pressure per square inch under pier

$$\frac{25000}{144} = 17.4 \text{ or, say, } 18 \text{ lbs.}$$

We must therefore make the foundation under gable wall still wider, in order to avoid unequal settlements. The pressure per running inch we found to be 936 lbs.; therefore the width required would be $= \frac{936}{18} = 52''$.

We therefore shall have to step out *each side* of foundation wall an amount $\frac{52-18}{2} = 17''$.

The safe compressions for different soils are given in Table V, but in most cases it is a matter for experienced judgment or else experiment.

Testing Soils. It is usual to bore holes at intervals, considerably deeper than the walls are intended to go, at some spot where no pressure is to take place, thus enabling the architect to judge somewhat of the nature of the soil. If this is not sufficient, he takes a crowbar, and, running it down, his experienced touch should be able to tell whether the soil is solid or not. If this is not sufficient, a small boring-machine should be obtained, and samples of the soil, at different points of the lot, bottled for every one or two feet in depth. These can be taken to the office and examined at leisure. The boring should be continued if possible, until hard bottom is struck.

If the ground is soft, new made, or easily compressible, experiment as follows: Level the ground off, and lay down four blocks each, say 3″ x 3″; on these lay a stout platform. Alongside of platform plant a stick, with top level of platform marked on same. Now pile weight onto platform gradually, and let same stand. As soon as platform begins to sink appreciably below the mark on stick, you have the practical ultimate resistance of the foundation; this divided by 36 gives the ultimate resistance of the foundation per square inch. One-tenth of this only should be considered as a safe load for a permanent building.

Drainage of Soil. Drainage is essential to make a building healthy, but can hardly be gone into in these articles. Sometimes it is also necessary to keep the foundations from being undermined.

It is usual to lead off all surface or spring water by means of blind drains, built underground with stone, gravel, loose tile, agricultural-tile, half-tile, etc. To keep dampness out, walls are cemented and then asphalted, both on the outsides. If the wall is of brick, the cementing can be omitted.

Damp-proofing. Damp-courses of slate or asphalt are built into walls horizontally, to keep dampness from rising by capillary attraction. Cellar bottoms are concreted and then asphalted; where there is pressure of water from

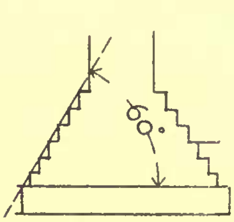


Fig. 40.



Fig. 41.

underneath, such as springs, tide-water, etc., the asphalt has to be sufficiently weighted down to resist same, either with brick paving or concrete.

Where there are water-courses they should be diverted from the foundations, but never dammed up. They can often be led into iron or other wells sunk for this purpose, and from there pumped into the building to be used to flush water-closets, or for manufacturing or other purposes. Clay, particularly in vertical or inclined layers, and sand are the foundations most dangerously affected by water as they are apt to be washed out.

Where a very wide base-course is required by the nature of the soil, it is usual to step out the wall above gradually; the angle of stepping should never be more acute than 60°, or, as shown in Figure 40. Care must also be taken that the stepped-out courses are sufficiently wide to project well in under each other and wall, to prevent same breaking through foundation, as indicated in Figure 41.

Where, on account of party lines or other buildings, the stepping out of a foundation wall has to be done entirely at one side, the stepping should be even steeper than 60°, if possible; and particular attention must be paid to anchoring the walls together as soon and as thoroughly as possible, in order to avoid all danger of the foundation wall tipping outwardly.

Where a front or other wall is composed of isolated piers, it is well to combine all their foundations into one, and to step the piers down for this purpose, as shown in Figure 42.

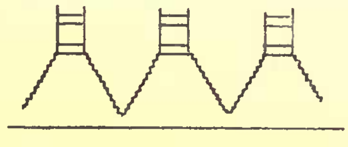


Fig. 42.

Where there is not sufficient depth for this purpose, inverted arches must be resorted to.

The manner of calculating the strength of inverted arches will be given under the article on arches. Inverted arches are not recommended, however (except where the foundation wall is

Inverted arches. by necessity very shallow), as it requires great care and good mechanics to build them well.

Two things must particularly be looked out for: 1, That the end arch has sufficient pier or other abutment; otherwise it will throw the pier out, as indicated in Figure 43. (This will form part of calculation of strength of arch.) Where there is danger of this, ironwork should be resorted to, to tie back the last pier.

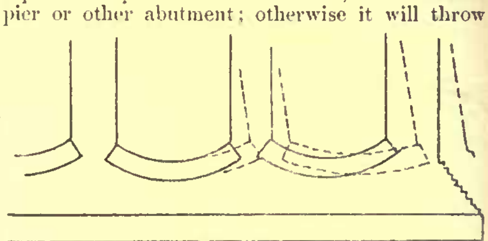


Fig. 43.

Size of Skew-back. 2. The skew-back of the arch should be sufficiently wide to take its proportionate share of load from the pier (that is, amount of the two skew-backs should be proportioned to balance of pier or centre part of pier, as the width of opening is to width of pier); otherwise the pier would be apt to crack and settle past arch, as shown in Figure 44.

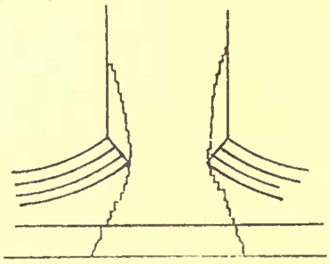


Fig. 44.

An easy way of getting the width of skew-back graphically is given below. In Figure 45, draw A B horizontally at springing-line of inverted arch; bisect A C at F, and C B at E. Draw E O at random to vertical through F; then draw O C, and parallel to O C draw G D; then is C D the required skew-back.[1]

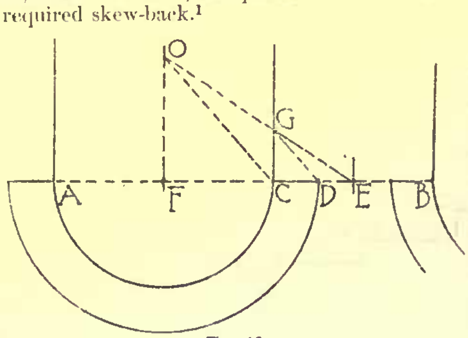


Fig. 45.

A good way to do is to give the arches wide skew-backs, and then to introduce a thick granite or bluestone pier stone over them, as shown in Figure 46. This will force all down evenly and avoid cracks. The stone must be thick enough not to break at dotted lines, and should be carefully bedded.

[1] In reality C D should be somewhat larger than the amount thus obtained; but this can be overlooked, except in cases where the pier approaches in width the width of opening. In such cases, however, stepping can generally be resorted to in place of inverted arches. Then, too, if the opening were very wide and the line of pressure came very much outside of central third of C D, it might be necessary to still further increase the width of skew-back, C D.

GLOSSARY OF SYMBOLS. — The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.: —

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
= *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_{I} = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
𝔇 = *diameter*, in inches.
𝔯 = *radius*, in inches.
π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{I}, a_{II}, a_{III}, etc., or b, b_{I}, b_{II}, b_{III}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance: —

m = moment or bending moment at *centre*.
m_A = " " " *point A*.
m_B = " " " *point B*.
m_X = " " " *point X*.
s = strain at *centre*.
s_B = " *point B*.
s_X = " *point X*.
v = stress at *centre*.
v_D = " *point D*.
v_X = " *point X*.
w = load at *centre*.
w_A = " *point A*.

Example.

A foundation pier carrying 150000 *lbs. is* 5′ *wide and* 3′ *broad. The inverted arches are each* 24″ *deep. What thickness should the granite block have?*

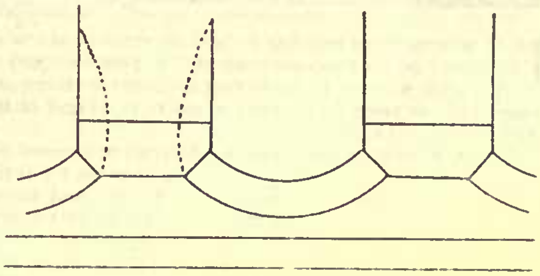


Fig. 46.

We have here virtually a granite beam, 60″ long and 36″ broad, supported at two points (the centre lines of skew-backs) 36″ apart. The load is a uniform load of 150,000 lbs. The safe modulus of rupture, according to Table V, for average granite is $\left(\frac{k}{f}\right) = 180$ lbs.

The bending moment on this beam, according to Formula (21) is

$$m = \frac{u.l}{8} = \frac{150\,000.36}{8} = 675\,000$$

The moment of resistance, r, is, from Formula (18)

$$r = \frac{m}{\left(\frac{k}{f}\right)} = \frac{675\,000}{180} = 3\,750$$

From Table I, No. 3, we find

$$r = \frac{bd^2}{6}, \text{ therefore}$$

$$\frac{bd^2}{6} = 3750 \text{ ; now, as } b = 36, \text{ transpose and we have}$$

$$d^2 = \frac{3750.6}{36} = 625.$$

Therefore $d = 25''$ or say 24″. The size of granite block would have to be 5′ x 3′ x 2′.

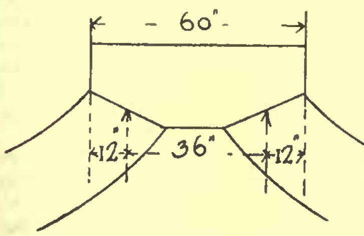


Fig. 47.

As this would be a very unwieldy block, it might be split in two lengthwise of pier; that is, two stones, each 5′ x 18″ x 2′ should be used, and clamped together. Before building piers, the arch should be allowed to get thoroughly set and hardened, to avoid any after shrinkage of the joints.

A parabolic arch is best. Next in order is a pointed arch, then a semi-circular, next elliptic, and poorest of all, a segmental arch, if it is very flat. But, as before mentioned, avoid inverted arches, if possible, on account of the difficulty of their proper execution.

Rock foundations. A rock foundation makes an excellent one, and needs little treatment, but is apt to be troublesome because of water. Remove all rotten rock and step off all slanting surfaces, to make level beds, filling all crevices with concrete, as shown in Figure 48:

In no case build a wall on a slanting foundation.

Look out for springs and water in rock foundations. Where soft

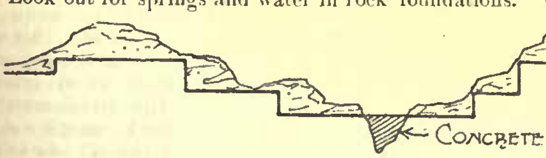


Fig. 48.

soils are met in connection with rock, try and dig down to solid rock, or, if this is impossible, on account of the nature of the case or expense, dig as deep as possible and put in as wide a concrete base-course as possible. If the bad spot is but a small one, arch over from rock to rock, as shown in Figure 49:

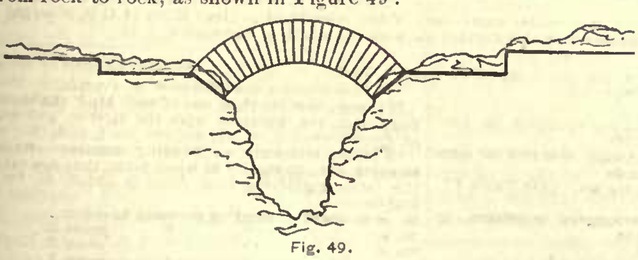


Fig. 49.

Sand, gravel and clay. Good hard sand or even quicksand makes an excellent foundation, if it can be kept from shifting and clear of water. To accomplish this purpose it is frequently "sheath-piled" each side of the base course.

Gravel and sand mixed make an excellent, if not the best foundation; it is practically incompressible, and the driest, most easily drained and healthiest soil to build on.

Clay is a good foundation, if in horizontal layers and of sufficient thickness to bear the superimposed weight. It is, however, a very treacherous material, and apt to swell and break up with water and frost. Clay in inclined or vertical layers cannot be trusted for important buildings, neither can loamy earth, made ground or marsh. If the base-course cannot be sufficiently spread to reduce the load to a minimum, pile-driving has to be resorted to. This is done in many different ways.

Short piles. If there is a layer of hard soil not far down, short piles are driven to reach down to same. These should be of sufficient diameter not to bend under their load; they should be calculated the same as columns. The tops should be well tied together and braced, to keep them from wobbling or spreading.

Example.

Georgia-pine piles of 16″ *diameter are driven through a layer of soft soil* 15′ *deep, until they rest on hard bottom. What will each pile safely carry?*

The pile evidently is a circular column 15′ long, of 16″ diameter, solid, and we should say with rounded ends, as, of course, its bearings cannot be perfect. From Formula (3) we find, then, that the pile will safely carry a load.

$$w = \frac{a.\left(\frac{c}{f}\right)}{1 + \frac{l^2.n}{\rho^2}}, \text{ now from Table I, Section No. 7, and fifth}$$

column, we have

$$a = \frac{22}{7}.\,r^2 = \frac{22.8^2}{7} = 201.$$

From the same table we find, for Section No. 7, last column,

$$\rho^2 = \frac{r^2}{4} = \frac{8^2}{4} = 16.$$

From Table IV we find for Georgia pine, along fibres, $\left(\frac{c}{f}\right) = 750.$

And from Table II, for wood with rounded ends,

$n = 0{,}00067$, therefore:

$$w = \frac{201.750}{1 + \frac{180^2.\,0{,}00067}{16}} = \frac{150750}{2{,}357} = 63958,$$

or say 30 tons to each pile.

Sand piles. Sometimes large holes are bored to the hard soil and filled with sand, making "sand piles." This, of course, can only be done where the intermediate ground is sufficiently firm to keep the sand from escaping laterally. Sometimes holes are dug down and filled in with concrete, or brick piers are built down; or large iron cylinders are sunk down and the space inside of them driven full of piles, or else excavated and filled in with concrete or other masonry, or even sand, well soaked and packed. If filled with sand, there should first be a layer of concrete, to keep the sand from possibly escaping at the bottom.

Where no hard soil can be struck, piles are driven over a large area, and numerous enough to consolidate the ground; they should not be closer than two feet in the clear each way, or they will cut up the ground too much. The danger here is that they may press the ground out laterally, or cause it to rise where not weighted. Sometimes, by sheath-piling each side, the ground can be sufficiently compressed between the piles, thereby being kept from escaping laterally.

Long piles. But by far the most usual way of driving piles is where they resist the load by means of the friction of their sides against the ground. In such cases it is usual to drive experimental piles, to ascertain just how much the pile descends at the last blow of the hammer or ram; also the amount of fall and weight of ram, and then to compute the load the pile is capable of resisting: one-tenth of this might be considered safe.

The formula then is: —

$$w = \frac{r.\,f}{10.\,s} \qquad (44)$$

Where w = the safe load on each pile, in lbs.
" r = the weight of ram used, in lbs.
" f = the distance the ram falls, in inches.
" s = the set, in inches, or distance the pile is driven at the last blow.

Where there is the least doubt about the stability of the pile, use three-fourths w, and if the piles drive very unevenly, use only one-half w.

Some engineers prefer to assume a fixed rule for all piles. Professor Rankine allows 200 lbs. per square inch of area of head of pile. French engineers allow a pile to carry 50000 lbs., provided it does not sink perceptibly under a ram falling 4′ and weighing 1350 lbs., or does not sink half an inch under thirty blows. There are many other such rules, but the writer would recommend the use of the above formula, as it is based on each individual experiment, and is therefore manifestly safer.

Example.

An experimental pile is found to sink one-half inch under the last

blow of a ram weighing 1500 *lbs., and falling* 12′ *What will each pile safely carry?*

According to formula (44), the safe load w would be

$$w = \frac{r.f}{10.\,s} \text{ we have,}$$

$r = 1500$ lbs.
$f = 12.12 = 144''$, and
$s = \frac{1}{2}''$, therefore

$$w = \frac{1500.144}{10.\frac{1}{2}} = 43200 \text{ lbs.}$$

If several other piles should give about the same result, we would take the average of all, or else allow say 20 tons on each pile. If, however, some piles were found to sink considerably more than others, it would be better to allow but 10 tons or 15 tons, according to the amount of irregularity of the soil.

All cases of pile-driving require experience, judgment, and more or less experiment; in fact all foundations do.

All piles should be straight, solid timbers, free from projecting branches or large knots. They can be of hemlock, spruce or white pine, but preferably, of course, of yellow pine or oak.

There is danger, where they are near the seashore, of their being destroyed by worms. To guard against this, the bark is sometimes shrunken on; that is, the tree is girdled (the bark cut all around near the root) before the tree is felled, and the sap ceasing to flow, the bark shrinks on very tightly.

Others prefer piles without bark, and char the piles, coat them with asphalt, or fill the pores with creosote. Copper sheets are the best (and the most expensive) covering.

Piles should be of sufficient size not to break in driving, and should, as a rule, be about 30′ long, and say 15″ to 18″ diameter at the top. They should not be driven closer than about 2′ 6″ in the clear, or they will be apt to break the ground all up. The feet should be shod with wrought-iron shoes, pointed, and the heads protected with wrought-iron bands, to keep them from splitting under the blows of the ram.

Sheath-piling. In sheath-piling it is usual to take boards (hemlock, spruce, white pine, yellow pine or oak) from 2″ to 6″ thick. Guide-piles are driven and cross pieces bolted to the insides of them. The intermediate piles are then driven between the guide piles, making a solid wooden wall each side, from 2″ to 6″ thick. Sometimes the sheath-piles are tongued and grooved. The feet of the piles are cut to a point, so as to drive more easily. The tops are covered with wrought-iron caps, which slip over them and are removed after the piles are driven.

Iron piles. Piles are sometimes made of iron; cast-iron being preferable, as it will stand longer under water. Screw-piles are made of iron, with large, screw-shaped flanges attached to the foot, and they are screwed down into the ground like a gimlet.

Sheath-piling is sometimes made of cast-iron plates with vertical strengthening ribs.

Where piles are driven under water, great care must be taken that they are *entirely immersed*, and at all times so. They should be cut off to a uniform level, below the lowest low-water mark. If they are alternately wet and dry, they will soon be destroyed by decay.

Base-courses over piles. After the piles are cut to a level, tenons are often cut on their tops, and these are made to fit mortises in heavy wooden girders which go over them, and on which the superstructure rests. This is usual for docks, ferry-houses, etc. For other buildings we frequently see concrete packed between and over their tops; this, however, is a very bad practice, as the concrete surrounding the tops is apt to decay them. It is better to cover the piles with 3″ x 12″ or similar planks (well lag-screwed to piles, where it is necessary to steady the latter) and then to build the concrete base course on these planks.

Better yet, and the best method, is to get large-sized building-stones, with levelled beds, and to rest these directly on the piles. In this case care must be taken that piles come at least under each corner of the stone, or oftener, to keep it from tipping, and that the stone has a full bearing on each pile-head. On top of stone build the usual base-courses.

Piles should be as nearly uniform as possible (particularly in the case of short piles resting on hard ground), for otherwise their respective powers of resistance will vary very much.

Slip-joints. It is well to connect all very heavy parts of buildings (such as towers, chimneys, etc.) by vertical slip-joints with rest of building. The slip-joint should be carried through the foundation-walls and base-courses, as well as above.

Where there are very high chimneys or towers, or unbraced walls, the foundation must be spread sufficiently to overcome the leverage produced by wind. These points will be more fully explained in the chapter on "Walls and Piers."

Action of frost. All base-courses should be carried low enough to be below frost, which will penetrate from three to five feet deep in our latitudes. The reason of this is that the frost tends to swell or expand the ground (on account of its dampness) in all directions, and does it with so much force that it would be apt to lift the base-course bodily, causing cracks and possible failure above.

Louis DeCoppet Berg.

[To be continued.]

Books and Papers

It is especially a Frenchman's gift to write a book which is agreeable, interesting, apparently instructive and eminently readable, but which, when one gets to the end of it, leaves an opportunity to the reader of wondering why what seemed so vivid and interesting as he read has not left more definite impressions on the mind. To write an unillustrated book about some of the little-known manners and customs of the Chinese in such a way as to make one feel that he is actually there and seeing with his own eyes the articles and actions described would be for any but a French writer far from an easy task; but here is a writer [1] who has contrived to interest us as much in the actions of two fishermen wading about in a bit of overflowed meadow catching frogs and minnows, as in the fact that in examining at a bookseller's a book *printed* in 1282 he discovered that the wear and tear of ages had been effaced in a way peculiarly typical of the patient children of the Son of Heaven. On holding up the leaves of the book to the light he discovered that the ravages of bookworms, vermicular not bipedal, had been repaired by insetting in the leaf, with such minute exactness that the work could not be detected, unless held against the light, microscopic squares and rounds of paper, brought to the proper tone with the rest of the page. In a single leaf forty-three of these microscopic patches were counted. Without being able to recall just how a Chinese book differs in appearance from the familiar Japanese pamphlet, the reader cannot but feel that he too sees the treasures that the two bibliophiles, one European, the other Asiatic, pore over with so much delight. One sample of multi-color printing excites our admiration as it did theirs, and suggests a manner of annotation that might be of value, say, to Shakesperian scholars. This book was printed in 1685, the time of greatest literary culture, and the body of the text is printed in black; notes extracted from authors dead at the time the book was printed are in blue, the mourning color of the Chinese; the comments of the emperor Kang-chi, in yellow, the dynastic color of his house, which still reigns; the notes of his teachers are in green, and the remarks of *literati*, still living at the time of publication, are in red. All these notes are so disposed on the page as to give an agreeable general effect, some for the purpose being even interwoven in the text, others are in the margin, and still more at the top of the page in reversal of our habit of placing foot-notes at the bottom. Yet, in spite of each page having to "go to press," as it were, six times, there was no indication of misregister on the part of the presumably simple mechanism employed to produce the impression. The question is sometimes raised as to how a Chinaman comports himself when, after having enjoyed the advantages of Western civilization, he returns to spend in the home of his ancestors the sufficient fortune he has by shrewd economy and industry secured from those outer barbarians. This may be answered, so far at least as those who are really wealthy are concerned, by surmising that they follow the example of one of our author's friends who, on his return, divided his large house into two parts, one furnished entirely in the native style, where in the library the Chinese books are piled one on top of the other, after the fashion of the land, where are kept his magnificent collections of china and Oriental bric-à-brac and his harem of Chinese wives, living mainly on the floor, eating with chop-sticks, and lighted by the smokey lantern at night. To this part of the house only Chinese guests are, as a rule, admitted. In the other part of the house velvet carpets, stuffed furniture, and hangings abound; the fine library of books in all European languages is arranged on bookshelves in what we consider the proper way; gas supplied by a portable machine lights the rooms, and, for aught we can say, a European female contingent may form a fair substitute for the almond-eyed beauties on the other side of the wall. But the returned disciple of Confucius shows his respect for the conservatism of his fellow countrymen by carefully excluding them from this side of his dwelling, and so avoids contaminating their morals and bringing about that revolution of modern progress that all good Chinamen dread.

Europeans have gathered together collections of the most varied and singular articles, and whether the object of their devotion is porcelain, pipes, stamps or bits, each is equally absorbed in his hobby, but we do not believe that the mania for collecting India ink has yet been transported to the Occident. In China it is not an uncommon hobby to ride, and the most curious fact about it is that the collector does not allow himself to test the quality of his treasures, each stick is still virginal and the most precious is that to which the greatest antiquity can be ascribed, for in this, as in all else, the cult of age is paramount. One habit which is said to be universal amongst the better class in China goes far to explain a matter which has at times excited our casual wonderment. What becomes of all the watches that are manufactured every year by the hundred thousand? An English mathematician has shown what may possibly become of all the pins, by comparing the number manufactured with the area of the earth's surface plus the floor area of upper stories, and satisfactorily demonstrating that one is more likely to find the proverbial needle in the hay-stack than a pin in a given spot. But watches are

[1] "*La Chine inconnue*," par Maurice Jametel, élève diplomé de l'ecole des langues Orientales mortes; Lauréat de l'Institut de France, etc. Paris, 1886. Libraire de l'Art. J. Rouam, éditeur; 3 francs.

treated with more respect than pins, and good ones such as the great factories now make will last for many years, and though a greater array hang in pawn-brokers' windows than formerly, a large number must find other resting places. Our author points to one good market for our watch-makers by declaring that the mandarins carry watches, not one, but invariably two, which, funnily enough, are both carried in the same pocket, or what serves for a pocket. It is easy to see that if only one per cent of a population of two hundred and fifty million souls carry watches five million time-pieces will be needed to enable a single generation to keep its appointments. The origin of this fashion is unfathomable; it is not display for no watch-chains or guards of any kind are worn.

If any of our readers come upon this little book they can find a couple of hours' entertainment within its covers, and a good deal of curious information.

We believe that Professor Merriam has done a very judicious thing in issuing a "key"[1] to his book "*On the Mechanics of Materials*," and we hope it will find its way into the hands of all who have bought his book. It was a mistake, we think, not to give in the original book the answers to the problems suggested, for, granted that the book was mainly prepared for use as a text-book for use at Lehigh University and similar institutions, and that the pedagogic mind believes that a better mental training can be had by making the student rely absolutely on his own powers of reasoning, it should have been foreseen that so good a book would inevitably find its way into the hands of many who had not been trained in the mental gymnastics of the school and lecture-room, but who, being momently engaged on practical construction, would have forced on them the chances of committing errors through a false understanding of the explanations given, which would have been avoided if the opportunity had been afforded them of comparing the results of their own computations with "the answers in the book."

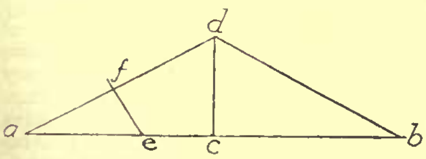
COMMUNICATIONS

TO FIND THE BEVEL OF A HIP-RAFTER.

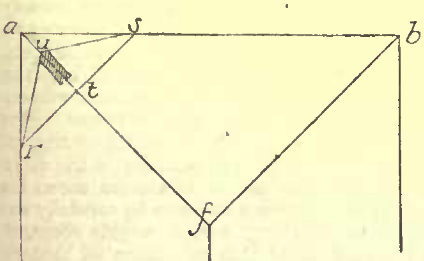
Charlestown, Mass., January 22, 1887.

To the Editors of the American Architect: —

Dear Sirs, — Will you or some of your readers have the kindness to answer the following query through the medium of your correspondence column, for the benefit of one who is in great need of a quick and simple way of performing such operations: —



How to find the angle of the hip when are given angles *a* and *d*? I wish for a rule that will be easy to apply. Our firm makes large quantities of "hip roll," and the architects always give us the pitches, and we have to find what the angle of hip is, ourselves, and the way we do it now costs a good deal, and takes considerable time, hence my inquiry.



Yours respectfully,

"Anxious."

[A moment's reflection will shew our correspondent that the correct form of his hip-rafter can be found only by a section made at right-angles with its length. When this is found, his riddle is answered. It requires only a slight imaginative effort to reduce the solution to graphical form. The upper cut represents the gable end of a roof, *a d* and *d b* indicating the hip-rafters. The lower cut represents a plan of one end of the roof, the same rafters being represented by *a f* and *b f*. If a plane is imagined to pass through the rafter *a d* at right-angles to its length, it will cut the roof at three points which it is easy to determine, one the point *f* at the top of the rafter, another the point *e*, where the perpendicular *f e* strikes the plate, and which is represented by *r* on plan, and the corresponding point on the other plate which is shown at *s* on plan. Imagine that this plane is hinged so that it can be folded down. It is plain that the point *f* will be found on plan at *u*, at a distance from *t* equal to the distance *e f*. If the point *u* is connected with *s* and *r*, the inclination of the slope of the roof is found, and by laying off on either side of *a f* half the thickness of the rafter, the proper right section of the rafter will also be shown on paper. — Eds. American Architect.]

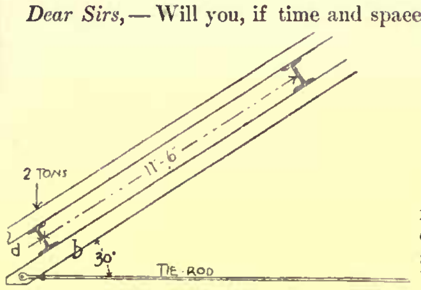
[1] "*Key to the Textbook on the Mechanics of Materials*," and of Beams, Columns and Shafts. By Mansfield Merriam, Professor of Civil Engineering in Lehigh University. New York: John Wiley & Sons; 1886.

THE PROPER POSITION OF AN IRON PURLIN.

Cleveland, O.

To the Editors of the American Architect: —

Dear Sirs, — Will you, if time and space in your paper will allow, answer the following:





Let a roof-truss of say 80 feet span, of iron, have 12 feet between centre of principals, and slope of 30°, and let load on each apex be, say 2 tons, which will be equal to 2 tons uniformly distributed on each purlin, *a*. Now you will please decide: 1. Should the place of the web in I-beam *a* be vertical, or sinclined a shown? 2. If inclined, will not the weight of 2 tons act transversely in two directions (see small cut)? and if so, how should the weight be considered in computing section of purlin? An answer will oblige, One of your Readers.

[The web of the purlin should, in ordinary cases, lie in a plane normal to the inclination of the roof. If the jack-rafters abut on a plate at their foot, as they would naturally do, a vertical load upon them is decomposed at the purlin into two forces, one of which acts in a direction normal to the plane of the roof, and is therefore to be resisted by the purlin in the same way that a horizontal beam resists a vertical pressure; while the other component acts in the line of the jack-rafter, and is resisted finally by the plate at its foot. The proportion between these two components and the original vertical force is represented, as the diagram correctly shows by the sides of a triangle having one side vertical, the second parallel to the inclination of the roof, and the third normal to it. — Eds. American Architect.]

NOTES AND CLIPPINGS

Paper Piano Cases. — Accounts are given in the German technical journals of some interesting experiments which have been made with success in the employment of paper in piano construction. The case is made entirely of paper, as a substitute for wood, the material being so compressed as to be susceptible of the high polish which is required for such instruments. As described, the color is a creamy-white; the tone is reported to be characterized by sweetness rather than loudness, the sound emitted, unlike the short broken note of the ordinary piano, being soft, full and slightly continuous, somewhat resembling that of the organ. This modification of tone, which must be considered an attractive feature, is attributed to the evenness of texture of the compressed paper. — *Lumber World.*

Durability of Raft-timber. — Raft-timber that has been floated down rivers has been ascertained to be no longer liable to the attack of dry-rot. So much so is this said to be the case that in Alsace it is customary to specify that only raft-timber shall be employed. The water slowly dissolves out the albumen and salts, and thus deprives the fungus of the nutriment needful for its development. A French investigator, we are told, has found by experiment that, whereas fresh sawdust when buried in damp earth rots away in a few years, sawdust which has been soaked for some time in water, and has been thereby deprived of soluble matters, will remain in the ground under similar circumstances wholly unchanged and only slightly tinged on the exterior with earthy matters dissolved from the soil.— *The Iron Age.*

The Stone Images on Easter Island. — A strange memento of an unknown race is the gigantic stone image from Easter Island, now on the way to the Smithsonian Institution. This lonely isle in the Pacific is of volcanic origin, and is but eleven miles long and six broad, and, from its solitary situation, is seldom visited. The natives, but few in number, are of the Polynesian race, and were originally exceedingly hostile to the few whites who visited them. But within the past twenty-five years they have embraced Christianity under the influence of French missionaries. The island is owned by a Tahiti firm, who utilize its fertile valleys for cattle raising. The remarkable features which distinguish it from other solitary islands are the huge stone statues, to the number of several hundreds, which lie scattered about They were chiselled with rude skill from the lava in the craters of extinct volcanoes, and transported to all parts of the island, where they were set up, but most of them have since been overthrown by earthquake shocks. Some of these statues are forty feet in height and some still remain unfinished in their quarries. Nothing is known of their origin. The present inhabitants possess neither the skill nor the tools for the work and have no appliances for transporting such immense masses of stone. Their traditions furnish no information, as they merely ascribe a supernatural origin. The statues are all grotesque effigies of human beings, and while they are low in the scale of art, they are evidently the work of a race centuries in advance of the present inhabitants. A theory has been advanced that Easter Island is the remnant of a submerged continent, and that the statues were made by a people who worshipped them as idols. But this is only theory without a particle of evidence to sustain it. The statue of the Smithsonian Institution is now on board the United States Steamer Mohican, which was, at last accounts, at Valparaiso. It weighs between twelve and fifteen tons, and it was with

great difficulty that it was placed on board the vessel, as the island has no good harbors, and although the image had to be transported overland about eight miles, there was not a tree to furnish the material. The Mohican finally obtained a few logs at Samoa, with which the work was accomplished. This is the second monster curio which has been taken away from Easter Island — a German vessel having secured one about two years ago. When it finds a permanent place here, our puzzled ethnologists may possibly be able to clear away the mystery of its origin by a careful study of its design and workmanship. — *Boston Transcript.*

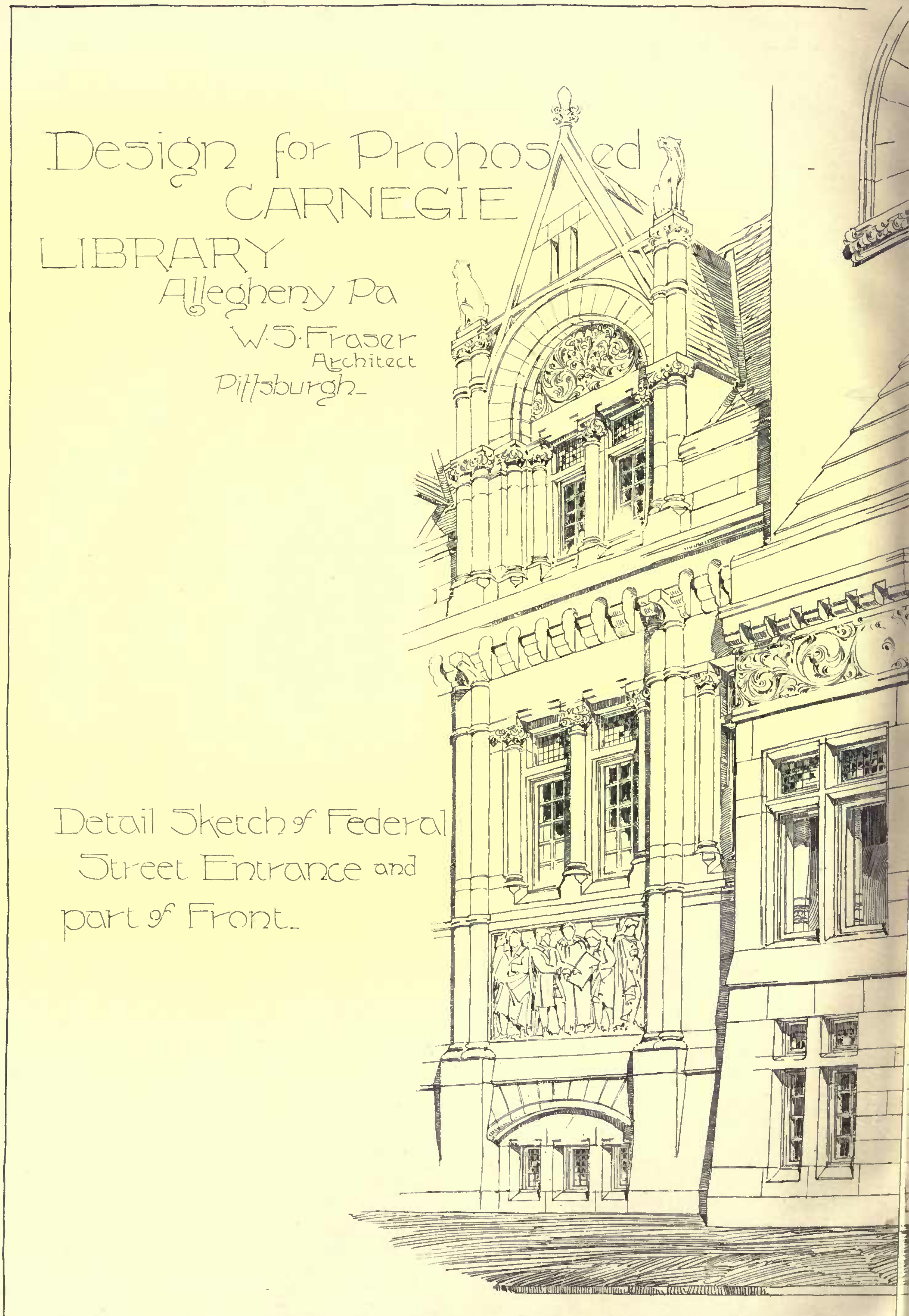
Utilizing the Water from the Severn Tunnel.— At length an effort is being made to utilize the 14,000,000 gallons of water per day which the Great Western Railway Company are pumping at the Sudbrook Springs on the Monmouthshire side of the Severn Tunnel and at present allowing to run to waste, while it costs them nearly £10,000 a year to pump it into the Severn estuary. The water has been submitted to analysis, and has been declared to be the purest spring water, entirely free from organic matter, and the finest water that could be desired for domestic purposes. The mayor of Bristol presided over a town meeting in the Guildhall on Wednesday in favor of a scheme for using this spring as a further water-supply for Bristol by bringing it across the Severn by a tunnel beneath the bed of the river. It was stated that the company formed for this purpose consisted of influential Bristol citizens, and as a desire had been expressed that the corporation should have the control of the water-supply of the city, the bill which had been drafted contained a clause enabling the corporation to exercise all the powers of the act on payment of the cost and expense incident to obtaining it, and sums expended by the company in exercise of its powers, with five per cent interest. The capital was £480,000 in 48,000 shares of £10 each, with borrowing powers to the extent of £120,000. Mr. S. Will moved the resolution in favor of the scheme, which was unanimously carried, as was also one requesting the corporation to avail themselves of the provisions of the bill, and suggesting to them the desirability of reopening negotiations with the existing water company for the purchase of their undertaking by the city upon equitable terms.— *London Times.*

Excavations around the Great Sphinx. — The London *Times* publishes an interesting account of the disentombment of the great sphinx, which was commenced by Maspero about a year ago and since carried on by M. Grébaut. The work was undertaken in 1869, at the opening of the Suez canal, and the figure was cleared from sand as far as the paws, but the sand accumulated again up to the throat. The excavations executed during the past year have again brought to light the fore paws. To the right of the sphinx — that is to say, in the direction of the granite temple, to the southward — a further excavation is in progress, the result of which will probably confirm the surmises of those who believed the sphinx to stand in the midst of a huge artificial amphitheatre hewn out of the solid rock. This gigantic work would, of course, be contemporaneous with the sphinx itself, which Mariette attributed to the mythic ages before the advent of Mena, the first king of the first dynasty, and which Maspero considers to be, if not actually prehistoric, at all events the oldest monument in Egypt. From the level of the area below the great flight of steps (which lead down, and not up, to the sphinx), one now measures the whole height of the huge human-headed monster, whose battered countenance stands out against the cloudless sky one hundred feet above. The space between the paws is thirty-five feet long and ten feet wide. This space was anciently converted into a small sanctuary lined with votive tablets, only one of which — the famous stela of Thothmes IV — yet remains *in situ.* This stela records how the king, when upon one of his hunting expeditions, lay down to rest at midday in the shadow of the sphinx. He there fell asleep, and dreamed a dream in which the venerable image conjured him to clear away the sand in which it was nearly buried. Then the prince awoke and "made silence in his heart," and vowed to do that which the god had commanded. The lower part of this tablet is obliterated, and Mr. W. M. Flinders Petrie, who visited the spot about a fortnight ago, reports that an important part of the fourteenth line, containing the name of Khafra (Chephren), has scaled off since the last time the inscription was copied. The tablet stands fourteen feet high, and is cut from a block of the same red granite of Assouan whereof the neighboring Temple of Khafra is built. There seems, according to Mr. Petrie's report, to be very good reason for concluding that the pious Thothmes, notwithstanding his respect for the memory of Khafra, actually pilfered this very block from Khafra's own temple, for in the back of it there are two pivot holes, or, rather, "holes for letting in pivot blocks," precisely similar to the pivot holes which are to be seen in the lintel-stones and door-sills of that building. The granite altar between the paws is of the same syenite, and most probably came from the same convenient quarry. This last, however, is of Roman work, very roughly executed. The paws of the sphinx, as they now appear, are a restoration of Roman date, being cased in comparatively small slabs, and to some extent hollow underneath. The breast of the sphinx has likewise been faced with slabs, apparently in Roman times, and these slabs have again been repaired by cutting away the weathered surface and inserting a fresh facing. Like the legs of the Colossi of the plain, and those of the great statues of Aboo Simbel, the paws of the sphinx are covered with the Greek scrawls of early travellers, but these *graffiti* are mostly of a late period, and so slightly scratched that few are legible throughout. Such as they are, however, Professor Maspero has, it is understood, devoted himself to the ungrateful and difficult task of translating them. M. Grébaut's excavations are not limited to the clearance of the sphinx only. Various interesting tombs have lately been discovered in the vicinity of the great pyramid, and to the westward the face of the Libyan Cliff has been reached, where it forms the natural boundary of the pyramid plateau. Some good early rock-cut tombs, with built fore-courts, have been found in the face of this cliff, in two of which the walled-up recesses or secret chambers called "serdabs," which were conducted for the safe keeping of funerary portrait statues, are yet intact with their contents.

The Long Tunnel at Schemnitz. — An engineering work that has taken over a century to construct can hardly fail to offer some points of interest in its history, and illustrate the march of events during the years of its progress. An instance of this kind is to be found in a tunnel not long since completed, but which was commenced over a hundred years ago. This tunnel, or adit, as it should be more strictly termed, is at Schemnitz, in Hungary. Its construction was agreed upon in 1782, the object being to carry off the water from the Schemnitz mines to the lowest part of the Gran Valley. The work is now complete and, according to the *Bauzeitung für Ungarn*, it forms the longest tunnel in the world, being 10.27 miles long, or about one mile longer than St. Gothard, and 2½ miles longer than Mount Cenis. The height is 9 ft. 10 in. and the breadth 5 ft. 3 in. This tunnel, which has taken so long in making, has cost very nearly a million sterling, but the money appears to have been well spent; at least the present generation has no reason to grumble, for the saving from being able to do away with water-raising appliances amounts to 15,000*l.* a year. There is one further point, however, worth notice, for if we have the advantage of our great grandfathers, in the matter of mechanical appliances, they certainly were better off in the price of labor. The original contract for the tunnel, made in 1782, was that it should be completed in thirty years and should cost 7*l.* per yard run. For eleven years the work was done at this price, but the French Revolution enhanced the cost of labor and materials to such an extent that for thirty years little progress was made. For ten years following much progress was made and then the work dropped for twenty years more until the water threatened to drown the mines out altogether. Finally the tunnel was completed in 1878, the remaining part costing 22*l.* a yard, or more than three times as much as the original contract rates.— *Engineering.*

TRADE SURVEYS

During the past few days a multitude of newly-projected enterprises and extensive building-operations have come to light. Architects in New York, Philadelphia and Chicago, taking these cities as samples, have a much larger amount of business in hand at the opening of February than a year ago. Builders in those three cities have made contracts for extended building. Material-men have made contracts for supplies. Much work is to be done this month of a preparatory character. The higher range of prices during the past few months has strengthened the conservative industrial tendencies. Nothing will be undertaken but what has the promise of prompt returns stamped upon it. The only exception to this may be railroad-building. No doubt a moderate percentage of the 12,000 miles of road to be built this year will be caught in receivers hands in 1889 or 1890, but the community at large will be benefited in the meantime by the multiplied opportunities for the probable employment of labor and enterprise. The disappearance of eight hundred millions of capital into temporarily unremunerative channels will be offset by abundant chances to the great middle-class operators whose capitals run from $10,000 to $100,000. In fact, these little people, firms and companies will rapidly multiply in the next year or two by force of circumstances, and the immensely-rich corporations will find silken thread tied around them by the rising Lilliputian army. The monopolistic tendencies of a few years ago still exist, but the meat they feed upon is thinner. Corrective agencies more powerful than legislative wisdom can supply are at work opening the way for the new men who have taken their lesson in trade and manufacturing during the past ten years. This is made more and more evident by the failures of stock manipulators to control the markets in their selfish interests. Building operations this year will be similar in most respects to those of last year. A large amount of shop and mill building hangs on the outcome of trade developments of the next sixty days. If the distributing agencies are able to meet the expectations of the manufacturing interests during that time the latter will enter upon enlargements and improvements on an extensive scale. In a word, if the manufacturer, big and little, finds the markets will take all he is now offering them through jobbers and sale-agents they will enlarge; if not, not. But enough is already known upon the direct and indisputable authority of many of the architects and builders of high repute East and West, to say that the season will be a very active one in all directions. More frequent reference is made to the iron and steel interests than perhaps is necessary; but these interests are accessible and they very correctly reflect other interests and trades. A few plain facts will express more than the best opinions. A New York steel importer stated last week that he had contracted for the delivery of over 200,000 tons of foreign steel, and that the importations might, and probably would, reach 400,000 tons. There are at this time inquiries from railroad and other bridge-builders for some 25,000 tons of material, and during the week past contracts have been placed for 5,000 tons. Inquiries have also been made for 150 miles of gas-pipe, for large quantities of water-pipe and waterworks material. Railroad companies will place orders before April 1 for over 250 locomotive engines, and if all the facts were known this might, and probably would, prove to be a very small estimate. Just what the widely-scattered car-builders and the extremely reticent ship and boat builders have in sight must be for the present matters of guesswork. Prices at furnaces and mills are higher than a week ago. The lumber yards of the country are idle, but all lumber authorities unite in saying an early and active spring trade is assured, though very little is said about higher prices. The coal trade is active everywhere except where interrupted by strikes. Combinations on the eve of formation will regulate production in the interest of steady prices. All the great industrial interests are quietly awaiting the natural returns of trade, which it is generously agreed will be earlier than usual. Enterprise in the South continues to attract much capital, but the failures, few of which reach the public ear, are just sufficient to remind enthusiastic pioneers in new fields that there is always danger to be feared. The Northwest is opening up rapidly and is helped by the development of coal beds and the construction of railroad lines to lumber regions. Chicago land-operators and house-builders expect to make heavy investments this season to provide for the needs of emigrants who are seeking better opportunities in the far Northwest than are to be found in many of the worn-out agricultural localities of the States between the Mississippi and the Alleghenies. The population is redistributing itself because the 30,000 miles of railroad built during the past few years has made it possible for tens of thousands to sell out old homes and find better ones farther West and South. This depression is a factor not to be overlooked on arriving at a proper understanding of the changing industrial conditions.


Design for Prohosed CARNEGIE LIBRARY
Allegheny Pa
W. S. Fraser Architect Pittsburgh
Detail Sketch of Federal Street Entrance and part of Front



Heliotype Printing Co. Boston

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, TICKNOR & COMPANY, Boston, Mass. No. 581.

FEBRUARY 12, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

THROUGH the initiative of the energetic Master-Builders' Association of Boston, steps have been taken towards the formation of a National Association, including a representation of all the various industries interested in the construction and erection of buildings throughout the United States; and a call has been issued by a committee chosen at an informal preliminary meeting, held in Boston last month, for a Convention of Master-Builders, to be held in Chicago, on Tuesday, the twenty-ninth day of March next, to form a definite organization. The master-builders' exchanges, or associations, of cities having not less than fifty thousand inhabitants, are entitled each to send seven delegates to the Convention, provided the association sending delegates represents a membership of not less than fifty firms; and under certain conditions, where no general builders' association exists, the separate trade associations, if there should be such, are entitled to unite in the election of delegates. There is every reason to believe that the formation of such a National Builders' Association would be of great service to the public, and as the names of the committee having the matter now in charge include those of some of the ablest and most energetic men in the United States, it is certain that nothing will be left undone to begin its work in the best possible way. Every one now acknowledges that the friendly connection among architects, which has been established by the formation of the various local and general associations, has been of immense benefit to the profession in this country; and architects will be particularly interested in observing the good effect of wider sympathies, and greater liberality in comparison of views and giving up of local prejudices, among their friends the builders, whose trials they are better able than any others, not directly interested in the business of building, to appreciate.

THE Ohio State Association of Architects has just held its semi-annual meeting, and appears to be in a flourishing condition, fifty-seven members having already been admitted, twenty-one of whom belong to the Cincinnati Chapter, while local affiliated societies have been formed in Cleveland, Toledo, Columbus and Dayton. The question of the licensing of architects was earnestly discussed by the meeting, and a draft of a bill relating to the subject, to be presented to the Legislature, was finally adopted. This draft proposes that every person applying for a license to practise architecture in the State shall pass an examination before a board of five architects of experience, to be appointed by the Governor, and provides that unlicensed persons who engage in professional work in the State shall be punished by a fine of not less than fifty nor more than one hundred dollars. We have serious doubts whether the public, as represented in State Legislatures, is yet ready for license laws in regard to the practice of architecture; but the unanimity with which the professional associations have recently undertaken to sift and improve their own membership, together with the growing feeling among them that some sort of regulation of architectural practice is necessary, indicate the existence of a strong professional sentiment, which will before long communicate itself to the outside world. After the conclusion of this business, the Association proceeded to the election of officers for the present year, choosing Mr. C. F. Schweinfurth of Dayton as President; Messrs. Aiken of Cincinnati, Barnum of Cleveland, Stribley of Columbus, Williams of Dayton, and Fallis of Toledo, as Vice-Presidents; Mr. F. A. Coburn of Cleveland as Secretary; Mr. H. C. Lindsay of Zanesville as Treasurer; and Messrs. Yost of Columbus, Weary of Akron, and Rapp of Cincinnati, as the Executive Committee.

THE *Spectator*, in speaking of the losses sustained by the insurance companies during the past year, says that although an unusual amount of property has been destroyed by fire, the companies have of late done so much to secure improvements in risks, and, by a mutual understanding with each other, to reduce the expenses incident to excessive competition and extravagant commissions, that it is believed that the net results of the year's business will be quite as favorable as those of any one of the past five years. It is hardly necessary to say that the good effect of a single year's strictness in regard to risks will continue at least as long as the policies issued during the year remain in force; and we sympathize with the *Spectator* in hoping that the companies will maintain their present attitude, and thus promote a reform which will bear fruit manyfold, for them as well as for the public. The *Spectator* goes on to say that "the success of the New York compact, in spite of all opposition and hostility to it, has been pronounced," and it predicts that before the end of the present year similar organizations will be formed in all our large cities. If this prediction should be verified, and if, we must add, the other underwriters' associations should all be managed with the earnest zeal of that in New York, a new and most satisfactory prospect would be opened, not only for the insurance business but for all others. Speaking as outside observers, interested only in the promotion of good and substantial building, we venture to say that the New York Underwriters' Association has already had an influence upon the art of construction in that city of which it has little idea. Although a few of its rules were, as we think, injudicious, and others might have been improved by consultation with architects, its code was, on the whole, excellent, and, what is more, it was enforced with tolerable thoroughness. If it had not been enforced, it would have been worse than useless; and for a time it was very doubtful whether the Association could maintain its stand against the powerful influences which resisted its efforts; but it held out bravely, and has now enlisted in its support a considerable portion of the public, which at first held aloof to see whether it really intended to carry its professions into action. In the first rank of its new allies, whose support is no less effectual because it is silently given, should be counted the New York architects, whose courage in planning and building safely and well has been greatly fortified, within the last few years, by the managers of the Association, whose rules they have been diligent in disseminating and improving upon. It is not many years since blocks of stores in the heart of the dry-goods district, intended to contain millions of dollars' worth of property, were built with cast-iron fronts, which did not touch, by several inches, the party-walls behind them, but left a wide crevice between the stores, the whole height of the building, covered with a little sheathing, or a few laths, plastered. There was probably not an architect in the city who would not have condemned such construction, but in those days it was useless to make suggestions in regard to precautions against fire, which were met with the invariable answer that "the insurance companies will not make us any allowance for that," or "that it will make no difference in the premium rates, and we might as well save the expense." Even later, when an ostensible attempt had been made to fix a schedule of rates, the architect who quoted the schedule was likely to be informed that these were only nominal, and that the brokers could always get the minimum rate; and it was not until within a comparatively short period that the tariff could be relied upon by the architect as having any value, or that he could submit his plans to the managers of the Association, and return to his principal with a definite prospect of a five or ten per cent reduction, if the construction which he proposed was carried out. Then, for the first time, he found his suggestions listened to; his clients began to show a faint interest, not only in the disquisitions upon safe building to which

he treated them out of the stores of his professional knowledge, but in the novel devices by which he hoped to gain increased safety, and, with the help of the underwriters, a diminished premium rate. This good work has now gone on for some time, the underwriters sustaining the architects with their allowances in rates, and the architects zealously seconding the underwriters' regulations, and endeavoring to improve upon them, until the character of building in the most hazardous district of New York already shows a change. It would be too much to expect that a hundred million dollars' worth of badly-built stores should be pulled down or remodelled in five or six years, to suit the new ideas of insurance, and many handsome buildings will be a menace to the district as long as they stand; but their number is gradually diminishing, they are less profitable to tenants, through the high rating upon them, and the changed demand is being rapidly met by the erection of structures among which fires like those which have taken place in Worth Street and the neighboring region would be impossible.

"*FIRE AND WATER*" speaks quite strongly in favor of the use of tiles for roof covering, instead of slate, which is in this country almost the only material employed for pitch roofs in cities, or elsewhere in cases where shingles would be objectionable. As that excellent journal truly says, a slate roof under the action of fire, and particularly if water is thrown on it while hot, cracks and flies in all directions, opening crevices through which a strong draught is immediately set up, increasing the fury of the flames in the building which the roof is supposed to protect. On this account, even cedar shingles are preferred to slate for roofing by many experienced fire engineers, for the reason that, inflammable as they are, the shingles do not fly to pieces when a cinder falls on them, but char, and, until burnt through, at least serve to prevent fire inside the building from breaking out of the roof. Tiles, unlike slates, never crack or fly, but keep their place even when red-hot; and their thickness and non-conducting property enables them to keep the heat from cinders or burning brands for an indefinite time from affecting the boarding beneath them. The main objections to the use of tiles in this country have hitherto been their cost, and the difficulty of laying them so as to keep out our fine, drifting snows; but with a little effort, particularly if architects and insurance managers could act in concert in the matter, both defects might be overcome. A considerable demand would soon make tiles here as cheap as they are in England or France, or Germany, where they are the universal roof covering, and roofs laid with them might easily be made, not only impervious to snow, but proof against the shaking of winds or earthquakes, by laying them in mortar or cement. This, with cheap tiles, would not be an expensive matter, and while a slate roof constantly needs repairs, tiles in cement, laid on a roof of simple form, are almost indestructible. Thousands of roofs in France and Germany, laid in this way four or five hundred years ago, are still in good condition, and they not only are really solid and enduring, but look so, presenting an appearance of substantial comfort which architects well understand.

THE *Builder* gives a curious account of a banking building, recently constructed at Aden, which is well worth the notice of those who have the care of constructions in hot climates. Aden, or rather, Steamer Point, as the commercial part of the city is called, has the reputation of being the hottest inhabited place in the known world. The people who can afford to do so live among the hills behind the city, about the reservoirs which supply the municipal water-works, and so contrive to get a little cool air at night; but they must spend their daylight hours in the town, and they are quite willing to go to a good deal of expense to make their counting-rooms endurable. Although the place is nearly surrounded by a cordon of bare, rocky hills, there is no stone which proves durable for building, while wood, even if the white ants should spare it, soon decays in the thick moist air; so that there are practically no materials in the place fit for a permanent construction, and if there were any, the only workmen pretending to any skill in building are Chinese carpenters, who can only imitate what they are shown, and have no idea of working from drawings. Under these circumstances, it was natural that the architect, Mr. Alexander Kersey, of London, should have decided to build his banking-house of concrete, a part of the materials for which could be obtained on the spot, while nothing but the lowest grade of labor would be required for employing them properly. As a support for the concrete, a framework of iron beams and uprights was designed, forming a skeleton of the entire building. This metal skeleton was all fitted together in England, the bolt-holes drilled, and the pieces then numbered, taken apart, packed, and shipped to Aden, where they were put up again without difficulty. With the ironwork was sent Portland cement for the concrete, together with materials for plastering, and some ornamental details in artificial stone. A base-course was built of native stone, and the rest of the superstructure made complete of concrete, using the local pumice-stone, ground fine, for sand, and the coarser lumps for aggregate. With the English cement this formed a remarkably strong and light concrete, admirably suited to its purpose. The floors and roofs were made of the same concrete, supported by iron beams, and, for the sake of appearance, borders of tiles were set around the floors, and the space between finished with colored cement, trowelled to a smooth surface, while the ceilings and walls were plastered in a somewhat elaborate manner. As an indispensable part of the furniture, each of the bed-rooms which occupied the third story, and were intended for the bank officers and clerks, was fitted with a plunge bath, consisting of a large tank lined with tiles. It is hardly necessary to say that the exterior, as usual in hot climates, was shaded by verandas and arcaded porticos, and all doors and windows, both inside and outside the house, were fitted with blinds, made, however, so as to close tight during sand storms, which not unfrequently occur. So far, the structure has given great satisfaction, the concrete roof, particularly, which is made double, with an enclosed air-space, proving impervious to the heat of the sun; and we should hardly know what improvement upon it to suggest, except, perhaps, a cool-air supply, derived, like that which refreshes in summer the office of the New Orleans *Picayune*, from a jet of water falling in spray through a high vertical shaft. It may be that the saturated condition of the Aden atmosphere would prevent the evaporation which gives its cooling effect to the spray; and water may be too precious in that desert country to use in this way; but if fresh water could not be spared, the Red Sea is at the door, and a steam-pump would supply salt water in almost unlimited quantity.

RETURNING from the Arabian desert to chilly England, the same number of the *Builder* describes two occurrences of a sort familiar enough to us, who enjoy most of the experiences of the Equator and the North Pole every twelve months, but rare in the comparatively mild London climate. It seems that a cold day came recently upon the city, and many of the house water-pipes, which are usually left in what we should call a deplorably unprotected state, froze. In a certain house at Mill Hill Park, the cook lighted a fire, as usual, in the kitchen range. It was Sunday, and between the time when the fire of the day before went out and that when the new one was lighted, a longer time had elapsed than was generally the case, and in the meantime the pipes had frozen. It is hardly necessary to say that in a few minutes the "boiler," or, as we should call it, the water-front, exploded, instantly killing the housekeeper, the cook's sister, who was standing near. The coroner was called in, and, after remarking that he had a few hours before been summoned to consider the case of a boy who was killed in another part of London in precisely the same way, began to collect the opinions of his jury upon the matter. We all know something of the learning which is evoked upon such occasions, and it is not surprising to hear that one of the witnesses explained the accident on the theory that the fire had caused the water in the water-front to "boil away," and that when the heat had been conducted along the supply-pipe to the frozen place, the ice suddenly melted and ran into the water-front, which "being, as it were, sealed, with no escape for the steam," immediately burst. How this gentleman accounted for the "boiling away" of the water originally in the water-front, which he considered to be "sealed" against the escape of steam from melted ice, does not appear; but the most probable theory of the accident, that the pipes on both sides of the water-front were frozen, so that the pressure in it, when heated, accumulated until it gave way, seems to have been too simple to occur to any one. One of the jury, who appeared to know something of the subject, mentioned that a valve was made for placing on boilers of the kind, which prevented explosions, and should be always used. We can hardly imagine what this valve may be, but it ought to be remembered that few safety-valves, even if looked after with much more care than such things get in kitchens, would give much security against explosion under the conditions often present when hot-water pipes are allowed to freeze.

ENTHUSIASM AND ENTHUSIASM IN ART.



P. NOTHING great was ever done without enthusiasm.

Q. Do you mean nothing good and great?

P. I am not much inclined to regard anything as truly great that is not good. So much, however, must be conceded to the conventions of speech as to include in greatness some very flagitious achievements.

Q. How stands the condition of enthusiasm in regard to these?

P. We must needs admit a true and a false enthusiasm, and distinguish them accordingly as their objects are worthy or unworthy; that is, as they are competent to stand the test of accurate moral judgment, which is, in fact, the test of truth. The basis of enthusiasm is admiration, and, therefore, an object of enthusiasm is necessarily believed to be good according to the appreciation, faulty as it may be, of the enthusiast.

Q. Then the builders of the pyramids were enthusiasts, and the exterminators of the Albigenses?

P. Even so; no less than Columbus the navigator and Howard the philanthropist. And so far, therefore, it is clear that we cannot safely accept the sincerity of enthusiasm as entitling it to our sympathy. This caution is the more important, as enthusiasm is highly contagious. We say of the subject of it, that he himself is liable to be carried away by the excitement; and no less certain is the liability of such excitement to set up the like, as if by induction, among those who seem affected by it merely in consequence of proximity. Indeed, the derivation of the word and its definitions are sufficient to enforce such a warning.

Q. What and which do you refer to?

P. The Greek word enthusiasm is a combination of "God" and "within," implying inspiration, or rather possession, by a God; and the termination of the word is the form which implies sustained habit. The ancient application of it was to such real or supposed cases as the exalted condition of a prophet or prophetess, when the words that were uttered with all the fervor of passion and the energy of seeming conviction, were believed to be really inspired by a divine power finding utterance through the human organ. These utterances were often in the form of verse, and, as indeed the nearest approach to the same conditions, apart from the supernatural element, were recognized in the case of poets. The condition of high poetical excitement is so elevated beyond the ordinary excitements of mankind as to seem akin to the supernatural, and the venders of oracles could not but adopt the same form. The poet not only originates in marvellous perfection what the rest of mankind would be unable to produce with whatever degree of zeal and labor, but he constantly does so in a manner which seems to imply that he himself can neither explain nor command the process of his invention and happiness of his expression. Not merely out of the fullness of his heart does his mouth speak, nor at the dictates of his understanding; he rather obeys an impulse of imagination which, for the time, takes resistless command of thoughts and feelings together. By the contagiousness already alluded to, this enthusiasm will extend in this degree to whoever worthily appreciates the poetry. "If I am to deliver your verses as you would have me," said the actress to Voltaire, "the audience will think I am possessed." "If you are to do justice to my verses," was the reply, "you must not only seem, but *be* possessed."

Q. We are familiar, however, with the phrase "to be possessed by a devil"; and it expresses, I suppose, that subjection to a false enthusiasm at which we have already had a glimpse.

P. Enthusiasm, however, as enthusiasm, is one and indivisible; the misdirection of it is in no way attached to its essence. Robert Southey could never have been sustained through the unremunerative labor of composing his ponderous epics, but by the enthusiasm that assured him he was laying the foundations of deathless fame. This was a mistake, but the inspiring sentiment was a warm glow of refined pleasure, a sense of exalted admiration at the contemplation of the idea which he was excited to realize.

Such, it will be easily understood, is the nature of enthusiasm, that when it once gains the command there is but poor chance of calm judgment asserting control; and yet it is only on the strength of a certain basis of reasonableness that enthusiasm is saved from being an infliction and a misfortune. The force of enthusiasm is due to the stimulative power of imagination, which gives both definiteness and embellishment to an object of admiration; but imagination is given to fretting under the rule of sober reason and serious enquiry. To reason and analysis, therefore, must be secured an early opportunity, while imagination is kept in temporary check; there is no fear that it will be extinguished in a truly artistic nature. With such it is ever after the thoughts have been sent to range abroad in one direction now and now another, and still resolutely recalled and collated with the primary interest, that the most valuable imaginative crisis arrives. The crisis may be momentary, but it is conclusive for great issues. Influences intellectual, imaginative, sympathetic, fall in together and cluster around a central idea; and the resulting combination, though still it may be but a germ, takes every passion prisoner; love, admiration, enthusiasm are stimulated by it at first, and recur in all their freshness and energy whenever the mind recurs to it.



Q. I perfectly apprehend and assent to the genesis of artistic, or, indeed, other enthusiasm, as you set it forth; but I lose myself in a maze of abstractions and would fain have a concrete instance to hold hard by.

P. You are fully entitled to one. The most concrete of the arts is architecture, perhaps, and let the instance be architectural. The world happens, let us say, at the present time to be in want of a new admiralty; the site is determined; the accommodation prescribed in respect of a certain number of apartments of special dimensions and in somewhat complicated communication. Experience and intelligence will have more to do than imagination in fitting these elements advantageously into groups and sequences. Of this task much must be undertaken by intelligence alone; but the conditions are not so precise and rigid as to exclude all exercise of imagination; the reasoning powers, indeed, may often be thankful for imagination to come to the rescue when plodding processes of deduction have seemed to conduct, at least to what is little better, than the impracticable. Imagination which is without any responsibility for the difficulty is equally disembarrassed in sweeping away what has cost so much labor, in challenging one assumption after another, suggesting alternative possibilities; then the way is clear for presenting various forms of the most desirable combinations which are likely enough to contain the elements of the most acceptable solution, be it, after all, of necessity, a compromise. Such is the

function of imagination, even when bound to the service of the T-square and protractor. But it has higher services to render in the interests of expressive art. Such art has more to do than merely clothe the architectural skeleton; the perfection of the framework itself depends upon proportion, and this must be governed by taste inspired by the genius of the occasion. But inspiration depends on sympathy and sentiment, and these of appropriate variety, vivacity and dignity. It is not too much to ask that the architect of an admiralty should be imbued with a sense of the great importance of a centre of administration and organization,—of the very home and heart-source of energies on which national safety and national honor are promoted and preserved; that he should identify his feelings for the time with those of the most distinguished of a noble profession, from whose thoughts, amidst all dangers and perplexities, in storm, in battle, in negotiation, the image of this structure as material, symbol and embodiment of all their motives and purposes and aspirations, will not long be absent.

Q. Really, it appears to me that you are making a large demand upon your artist. It should be little more that the very air of the main staircase should waft the saltness of a sea breeze.

P. I do not think it impossible for architecture to receive such special treatment, and that not alone in its accessories, as to convey associations which are as stimulative of special reminiscences as your hypothetical briny whiff from the waves. Is it extravagant to demand that an admiralty shall be as expressive and impressive in its way and its degree as a church on the one hand or a prison on the other? We know too well that architectural style may be grossly inappropriate. Are not the groans audible, the protests articulate, of judges who administer the law of modern times in a building which aggravates its inconveniences by incongruous mediævalisms out of harmony with all progressive legislation? Graduated offensivenesses of discord are divergences from a harmony, but by the law of progress demonstrate its possibility. I do not pretend to explain how a naval character is to be given to architecture, though it is intelligible enough that incongruity with naval characteristics is a danger and can be avoided. My simple point is this: I can conceive that an artist, having fully digested the conditions of the supposed architectural problem, possessed, moreover, of a lively sense of all its bearings on the associations and sympathies of those chiefly interested in it, nationally and professionally, and having also the gift of creative—that is, of true poetic imagination, will ultimately, as he ruminates—"keeping the subject," as Sir Isaac Newton said, "constantly before the mind"—find his ideas fall into order and constitute a unity replete with all the charm and vitality of truthfulness and beauty. It is such a recognition that constitutes the ideal. The later endeavor to realize it has difficulties and struggles of its own. But this ideal is the true object of artistic enthusiasm; it is by recurrence to it that a sense of admiration, an inflow of ideas and images, an outburst of adventurous energy, revive inexhaustibility. Such a birth of invention is constantly sudden, but it can only manifest itself so suddenly because it has been long insensibly developing.

> All thoughts, all passions, all desires—says Coleridge—
> Whatever stirs this mortal frame,
> Are all but ministers of Love
> And feed his holy flame.

They feed it because love in whatever form is enthusiasm ever; and enthusiasm is a general exaltation of the faculties, and calls forth and commands the resources of all,—all that has been acquired and all powers of further acquisition, to concentrate them upon one single but all-comprehensive enterprise. We read in Fichte that the full account of all the causes which have produced a pebble and given it the particular position on the beach that it occupies, would be nothing less than an exposition of all the forces of the universe and their operations from all time. No less certain it is that when a conception worthy of the highest enthusiasm is born in the artistic mind it is an outcome moulded by all his past experiences, of courses of reflection even long since forgotten—of passions ever long since extinct. Thoughts and emotions may fade, but they leave their trace on the sensibility to enthusiasm, and on the character of the enthusiasm of which the mind becomes and remains susceptible.

W. Watkiss Lloyd.

Amount of Timber required for a Ship.—Fancy a single ship requiring 2,000 big oak trees in her construction. We can hardly conceive the enormous drain on our forests a fleet of similarly-constructed vessels would entail. From the calculations made, however, by the Commissioners of Inland Revenue a 74-gun wooden ship contained about 2,000 tons of oak, which, at the rate of a load and a half per ton, would give 3,000 loads of timber, and consequently would require 2,000 trees to build her. As not more than 40 oaks, yielding a load and a half, are reckoned to stand upon one acre of ground, it would take, therefore, 50 acres to produce the oak necessary to build a 74-gun frigate. It will be easy to understand what a vast saving of timber the adoption of iron-constructed vessels has brought about—not, however, to such an extent in the navy as at first blush might be supposed, though the saving in the merchant service must have been considerable. The hulls of the ships forming Her Majesty's fleet are still partly wood, the backing to the iron plates being an important factor in the consumption of timber, though this, after all, is a mere bagatelle as compared with what was formerly required, and certainly does not affect the oak market, the armour backing being principally teak.—*Timber Trades Journal.*

AMERICAN INSTITUTE OF ARCHITECTS.[1]—I.

Authorized Report, condensed.


In the Cloister of St. Trophime, Arles. From Revoil.

THE recent Convention of the American Institute of Architects was the first held in New York for seven years, and this, perhaps, partly explains the more than average attendance, notwithstanding the inconveniently and unprecedentedly late season of the year for which it was called. Upward of fifty, or somewhat more than a quarter of the professional members of the Institute, were present; though several of the most unfailing attendants of the previous annual gatherings were absent. So far, however, as we observed, none of its Honorary and but one or two of its Corresponding members availed themselves of the occasion to put themselves *en rapport* with the current developments of the specialty for amateur affiliation with which their election proves them to have been considered eligible. Perhaps this was because notifications of the Convention were not sent to them. If so, it is but another instance of much that is regretable in the administration of the Institute; traceable undoubtedly to its lack of resources, wherewith to enlist sufficient clerical force for current purposes; while it is obviously impossible permanently to secure adequate service on its higher planes, at the continued cost of the party from whom such service is expected.

As might be presumed, the New York Chapter was most largely represented, over twenty resident members having attended. New England sent nine or ten; Philadelphia, Baltimore and Washington somewhat over that; three or four came from the West, one from as far south as Alabama, and the remainder from various centres between the points named.

The Convention was held in one of the costliest and finest structures in the city, that belonging to the New York Mutual Life Insurance Co., the splendid Director's Room of which had been kindly placed at the disposal of the Institute through the fraternal intervention of the architect of the building, Mr. C. W. Clinton.

First Day, Morning.—The hour set in the programme for opening the first day's session was already past, when a telegram was received from the Secretary, Mr. Geo. C. Mason, Jr., of Newport, R. I., announcing that a sudden accident in his family would make it impossible for him to officiate as, up to the last moment, he had fully intended to do. Mr. Bloor was thereupon, as usual, compelled to fill the gap.

The venerable President, Thomas U. Walter, L.L.D., architect of the National Capitol at Washington, and of many other of the most important buildings in the country, then—though suffering from severe indisposition—opened the proceedings with a short address, referring to the enhanced artistic interest observable in comparatively small and unimportant brick structures of late years, largely through the use of decorative terra-cotta; noting the popular error that comfort, convenience and good taste in building operations are necessarily costly elements; adverting to the revival in domestic work, with modifications suitable to our era and habits, of the styles prevailing in the seventeenth and eighteenth centuries; calling attention to the remarkable spread of architectural societies in the West, of which he enumerated a dozen, headed by the Western Architectural Association; and suggesting that arrangements might be made with all such existing or prospective organizations to communicate annually with the American Institute of Architects such information as might enable the Institute, the mother of all of them, to furnish the entire confederative fraternity with succinct accounts of the status of the profession throughout the country.

The report of the Board of Trustees, referring to the bill now before Congress for the regulation of the architectural service of the Federal Government, stated that a committee, consisting of Messrs. Bloor, Hatfield and Littell, had been appointed to act with a joint committee, Messrs. Adler, Burnham and Alexander, on the part of the Western Association of Architects; that the duties of this Committee of Conference had been of a very responsible and onerous nature, and had involved no light labor of correspondence, as well as a visit to Washington by Messrs. Adler, Burnham and Bloor. The previous visit of Mr. Bloor to the Second Annual Convention of the Western Association of Architects, held in St. Louis, was noted, and the recommendation made that the committee be continued, and its work—begun twelve years ago by the Institute—steadily pursued.

A question of professional practice and etiquette had been raised between two members of the Institute, and presented to the Board; and, after voluminous correspondence and much discussion, had been laid on the table, on the understanding that the parties to the dispute should, if so disposed, lay their grievance before the Convention.

A letter, accompanied by a number of statistical documents, had been received from the Commission of Enquiry for the Revision of the Customs Tariff, appointed by the Italian Government, asking for information, which had been furnished, as to the titles of works on

[1] Twentieth Annual Convention of the American Institute of Architects, held in New York, on Wednesday and Thursday, 1st and 2d December, 1886.

political economy as exemplified in American industries in competition with the current world-wide commercial depression.

The paper on "Architects' Protective Associations" (published in the nineteenth *Proceedings*), by Mr. T. M. Clark, was referred to, and regret expressed that the author, owing to his professional engagements, and his absence abroad, had been prevented from a further development of the subject for presentation at the current convention.

At the request of the Boston Chapter, a circular letter, referring to its proposed memorial to the late H. H. Richardson, had been forwarded by the Secretary to each of the Chapters of the Institute, but without eliciting any response. The death, during the year, of that distinguished Fellow of the Institute, as also of Associate N. G. Starkweather, and of its eminent English Honorary Members, James Fergusson and Thos. L. Donaldson, as also of Lysandros Kaftangioglon, of Athens, Greece, had been the occasion of suitable resolutions of appreciation and respect on the part of the Board, which had been entered in their minutes, and transmitted to the family of each with proper expressions of sympathy and condolence. Those in memory of Richardson and Fergusson had been widely published in architectural serials, both at home and abroad.

The additions to the membership during the year had been seven Associates and six Fellows by first election, while seven members of the former grade had been promoted to Fellowship, a number of candidates' applications were under consideration, and correspondence was on foot looking to the establishment of Chapters in Pittsburgh and Indianapolis.

The Board had held seventeen meetings during the year, involving much labor, by far the greater burden of the drudgery inevitably attached to it falling of course on the Secretary. The number of letters received and answered had been very large, and embraced a wide range of subjects on professional matters in general, as well as on those pertaining more especially to the Institute. The elections had been numerous, involving the sending out to existing members of notices requiring the writing of about two thousand four hundred words in the case of each candidate.

The report called for a warm welcome, and God-speed to the architectural organizations springing up in the West, and invited attention to the fact that the economy in clerical and routine expenses, rendered necessary by the very slender pecuniary resources of the Institute, militates much to its disadvantage, inasmuch as opportunities are continually arising where much good could be accomplished, and the interests of the profession advanced were the Trustees in possession of a larger revenue. And it concluded by emphasizing the facts that the interests of the Institute and of the profession at large are one and the same, and that, though it stands as a bulwark behind the individual, sustaining him in his work, and interposing its time-honored schedule of professional practice between him and the evils of unregulated practice; it cannot, on the other hand, progress or maintain its hold upon the public without the steady support of its individual members.

The Treasurer's report called attention to the necessity of taking some steps to increase the Institute revenue, at present quite incommensurate to the important aims and purposes involved in its labors, and referred to a proposition moved in the Board by the Treasurer, but rejected by the Trustees, for establishing a grade of "Registered Subscribers," consisting of persons interested in the various trades and manufactures, more or less connected with building operations, whose contributions, while of value to the Institute, might be in a measure compensated for by the issue to them of its publications, including a copy of its annual Proceedings. Alluding to the penalty — twenty per cent — for delayed payment of dues, it noted that the excess had been cheerfully paid, sometimes after three or four years of delinquency, thus showing the wisdom of the action that substituted this rule in place of that of absolute dismissal from membership, which was formerly in force. The report also reverted to the old-time proposition (which was indeed put into practice for a short time) of issuing a monthly bulletin of the transactions of the Board, as likely to keep alive the interest of members and incite candidateship; and urged the project of the Institute securing a home for itself, the nucleus of a building fund having existed for several years in the shape of a gift of one hundred dollars, by an old member, and an appropriation by the Trustees of the general fund of a similar amount, both together, with their accumulated interest, now amounting to $267.25. The Treasurer's figures showed the following results for the year ending 1st October, 1886:

Receipts, ...	$1,653.14
Expenditures, ...	1,512.10
Balance . . .	$141.04

but with liabilities on running account of several hundred dollars above the balance, thus leaving, in reality, a considerable deficit to be liquidated from future receipts.

Messrs. Stone, Holly and Hunt were appointed Auditing Committee on the Treasurer's report.

Mr. Kendall announced the arrival of two delegates from the Western Association of Architects, Messrs. Root and Sidney Smith, and moved that they be welcomed by the Convention, and invited to participate in it. This was unanimously carried, and the gentlemen took their seats at the table.

Mr. Root, — I thank you, gentlemen, on behalf of myself and my *confrères*, for your courtesy. We shall always be glad to coöperate with you, both as individuals and as members of the Western Association of Architects. We do not understand that the Western Association is in any sense a rival of your Association; but its purpose, we know, is to continue the work so well begun here, and, more particularly, to adapt our Association to the cruder methods of the so-called "Wild West."

The reports on hand from various Chapters were then read.

The Baltimore Chapter, through its Secretary, J. A. Wilson, reported that it had a good library, but that few meetings had been held during the year.

The Cincinnati Chapter, Charles Crapsey, Secretary, simply renewed its allegiance to the Institute, and gave the usual list of members and officers.

The New York Chapter, A. J. Bloor, Secretary, reported an increase of four members, and stated that its Examination Committee had been called upon oftener than ever before to exercise, under the building law, their precautionary and discriminative functions in the case of buildings condemned by the Fire-department as unsafe, and the chairman of the committee had been elected chairman of a joint committee consisting of the Honorable Board of Fire Commissioners and the Board of Examiners of the Building Bureau to amend the present building law on a number of points in which it is still defective. This is a noteworthy step towards that official connection and that community of interests between governmental bodies and the profession which exist so largely in Europe, and which directly, and still more indirectly, contributes so effectively to the advantage alike of the profession, of the governmental authorities, and of the public.

The Willard Commission for the selection, purchase and placing of an architectural collection for the City of New York, and consisting of Messrs. N. Le Brun, Bloor, and Littell, are considering the important question of what to choose out of the selections made by their agent, Mr. Pierre L. Le Brun, and also the hardly less-important question of how to manage transportation from Europe at the least risk of breakage. This they have the opportunity to do without undue haste while waiting for the quarters to be appropriated to their collection, when the trustees of the Metropolitan Museum of Art have succeeded in building the extension to their structure, so long in contemplation and of which the foundations are now being laid. Meanwhile the $75,000 at the disposal of the commission, under the will of the public-spirited and far-sighted donor, Levi Hale Willard, are accumulating such interest as experienced financiers like Mr. John Taylor Johnston and Mr. Mr. Henry G. Marquand, the president and treasurer of the Museum, will doubtless secure for it.

Mr. Kendall, as president of the Chapter, had again under the law been called on to give his opinion as to the merits of a piece of statuary offered to the Central Park; in this case a colossal bronze bust of Washington Irving.

At the last meeting of the Chapter the secretary exhibited a number of photographic views showing the architecture and scenery of the Bermudas, which he had collected during a recent sojourn in those beautiful islands for the recuperation of his health.

As no convention of the Institute had been held in New York for seven years, and as members of the New York Chapter had been treated by members of other Chapters with the best hospitalities to be bought in their localities when conventions of the Institute have been held among them, the members of the Chapter had been called on by the Committee of Arrangements for this convention to contribute funds for the usual annual dinner; any possible surplus to be used for the increase of its library or other needful expenses.

The Philadelphia Chapter, Arthur Truscott, Secretary, reported that monthly social meetings at the members' residences had been held during the past winter. The meetings were well attended and were successful; questions of professional interest and matters of business being discussed during the evening.

The report went on to say that "the prestige of the Chapter has been recognized or acknowledged by the municipal authorities in the matter of the threatened repeal of the bay-window ordinance. This ordinance permits the erection of bay or oriel windows, above the first story, of any shape or plan inscribed within an angle of twenty degrees intersecting the party line, the projection being limited to four feet. The ordinance was repealed by Councils, but on objection being urged and arguments advanced by members of the Chapter the mayor vetoed it. The veto was sustained by Councils, no efforts being made by them to pass an ordinance over it.

Our Chapter has appointed a committee to confer with the carpenters' and master-bricklayers' association, at their request, in regard to the framing and presenting to the Legislature of new and more suitable building-laws for this city.

The discussions in which the Chapter took part, some years ago, in regard to "rules and regulations for the performing of plumbing and drainage," have at last resulted in the enactment of the rules and regulations proposed into an ordinance which now governs this class of work in the city.

The Rhode Island Chapter, E. I Nickerson, secretary, reported that it has continued to meet monthly, and to dine in one of the private parlors of the Narragansett Hotel. There has been an average attendance of more than nine in a Providence membership of thirteen.

The Committee on Entertainment prepared in advance a list of subjects for discussion at the several meetings, and also at each meeting presented an architectural problem from which impromptu sketches were produced. The variety of treatment shown has added much interest to each occasion.

The annual meeting was held with the Newport members' and an opportunity was afforded to examine some of the later work in that city.

The report of the Chicago Chapter was not received till the following day, when it was read. Since the Convention reports have been received from the Boston and San Francisco Chapters.

The Chicago Chapter, Alfred F. Pashley, secretary, reported that its meetings were in the nature of social gatherings. No set papers were read, but topics of general interest were incidently brought up and freely discussed. There is only one regular meeting in the year, but special meetings were called by the Executive Committee, if required. A new code of by-laws had been adopted. The last meeting of the year was held in the form of a banquet, when a committee was appointed to consider the proposition of the Boston Chapter to erect a monument to the memory of H. H. Richardson.

The Boston Chapter, E. M. Wheelwright, secretary, reports that "the dinners and meetings have been well attended during the year."

The action of the Court House Commissioners, in departing from the terms of the competition for the new Suffolk County Court House, made necessary a public protest from the society, published in the daily newspapers.

Changes have been made in the by-laws of the society. The most important is as follows;

"No person may be a candidate for junior membership of the society unless he has received the degree of A. B., B. S., or C. E., at some well-accredited institution of learning, or unless he has spent two years in the study of the profession, at some well-accredited foreign institution of learning; or unless he has been an associate member of some architectural society, for entrance to which a sufficient examination is required; or unless he has received an average of at least sixty per cent in the Rotch Travelling Scholarship examination. All candidates for junior membership must have served at least two years in an architect's office."

A new class of members, called associate members, has been established, constituted as follows:

"Associate members shall be such architects, residing outside a radius of thirty miles from Boston, who prefer not to join the Society as Fellows, and such other persons, not practitioners of the profession, whose membership may be thought desirable."

The Society has been entrusted with the funds and property of the Architectural Association of Boston, to be held in trust; the funds to be used in aid of the publication of the sketch-book instituted by the Association, or in publications of a kindred nature.

The Society has also been entrusted with the funds of the "Portfolio Club," to be used as a guarantee fund for publication purposes. This fund was earned by the sale of the "*Portfolio*," and was intended to form the nucleus for a travelling-scholarship fund, but as the Rotch Fund answers the original object of this fund, the trustees of the "Portfolio" Fund have made the above disposition of it.

There were this year three competitors for the Rotch Travelling Scholarship. The scholarship was given to Mr. Geo. F. Newton, of Boston. The sketches and drawings sent by the holders of this scholarship have been highly satisfactory to the Committee.

A committee has been appointed to raise subscriptions for a memorial to the late Henry Hobson Richardson, and the coöperation of the other Chapter of the Institute has been requested; but little encouragement for the project has thus far been received.

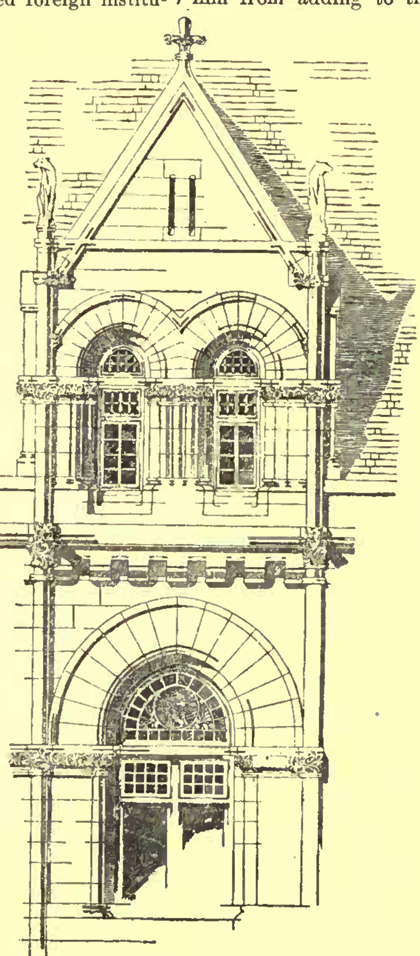
A very interesting exhibition of architectural drawings was given by the Society in the Art-Club Gallery. The exhibition was open nearly a month, was fairly-well attended, and excited very favorable criticism by the press. It was the first exhibition of purely architectural drawings ever given in this city. The expense of this enterprise, however, does not warrant its repetition under similar conditions, although all agree as to the great benefit to come to architects and draughtsmen by such exhibitions.

On various evenings the Society has had the following entertainments:

Mr. Henry Van Brunt read a paper to the Society upon the "Tendency of Modern Architecture." Mr. Frank H. Cushing gave the Society a description of the "Indian Architecture of the Southwest." Mr. Frederick Law Olmsted described the "Back Bay and Muddy River Improvements." Professor E. S. Morse described "Japanese Dwellings and Architecture."

An exhibition of Algerian photographs, and exhibition of the premiated designs for the "Suffolk County Court-House Competition."

The San Francisco Chapter, B. E. Hendricksen, Secretary, reports an increase of membership, bringing the total up to fifty-four persons, forty-four of them being of its highest professional grade, Fellows. At its meetings several interesting papers were read, which were afterwards published in the *California Architect and Building News.* Architectural practice is noted as in a flourishing condition in the field of the Chapter, and complaint made of the paucity of communications from the Institute.



Design for Proposed
CARNEGIE LIBRARY
Allegheny Pa.
W.S. Fraser Arch
Pittsburgh Pa.

The Secretary for Foreign Correspondence, W. L. B. Jenney, reported that he had sent a message of condolence to the widow of Lysander Kaftangioglon, late Honorary Member of the Institute, and had given a letter to Mr. James B. Willett, Associate, of Chicago, for presentation, during a trip abroad, to foreign architectural societies.

All the reports of the Chapters that had been presented, together with the Trustees' report, and the Treasurer's, so far as it related to points other than current financial ones, were, on motion of the Secretary, referred for consideration to a special committee, appointed by the Chair, *viz.*, Messrs. Renwick, Cutler and Frederick.

The Chair also appointed Messrs. Hunt, Nickerson and Wallingford, as a Committee on Nomination of Officers and Standing-Committees.

The Secretary read Mr. T. M. Clark's paper, in the Nineteenth *Proceedings*, on Architects' Protective Associations.

Mr. Kendall and Mr. Frederick thought the paper should not be discussed in Mr. Clark's absence.

Mr. Bloor thought that though Mr. Clark was not present, and, though his engagements and his absence in Europe had prevented him from adding to the paper what he had proposed, he would, nevertheless, doubtless be glad to have the subject discussed by the Convention. But if the Convention was not prepared to discuss it, he moved that it be referred for consideration to a special committee, of which Mr. Clark should be a member. Mr. Hatfield moved that Mr. Frederick be appointed a provisional committee of one, to consider Mr. Clark's paper and report at the next day's session. Carried.

Mr. Glenn Brown read a "Report on Experiments in Trap Siphonage, at the Museum of Hygiene, U. S. Navy Department, Washington, D. C." [Published in the *American Architect* of January 15, 1887.]

Mr. Frederick read a paper on "The Ethics of Architectural Practice [published in the *American Architect* of January 1, 1887.] A Special Committee, Messrs. Wallingford, Cutler and Moser, was appointed to investigate and report on any unprofessional conduct of any member of the Institute, to which reference might have been made in Mr. Frederick's paper.

The Chair announced that Mr. Bell, the Supervising Architect of the Treasury Department, wished the Convention to be informed that a pamphlet, giving a history of his office, would be found at Professor Ware's quarters, in Columbia College, for distribution among the members of the Institute.

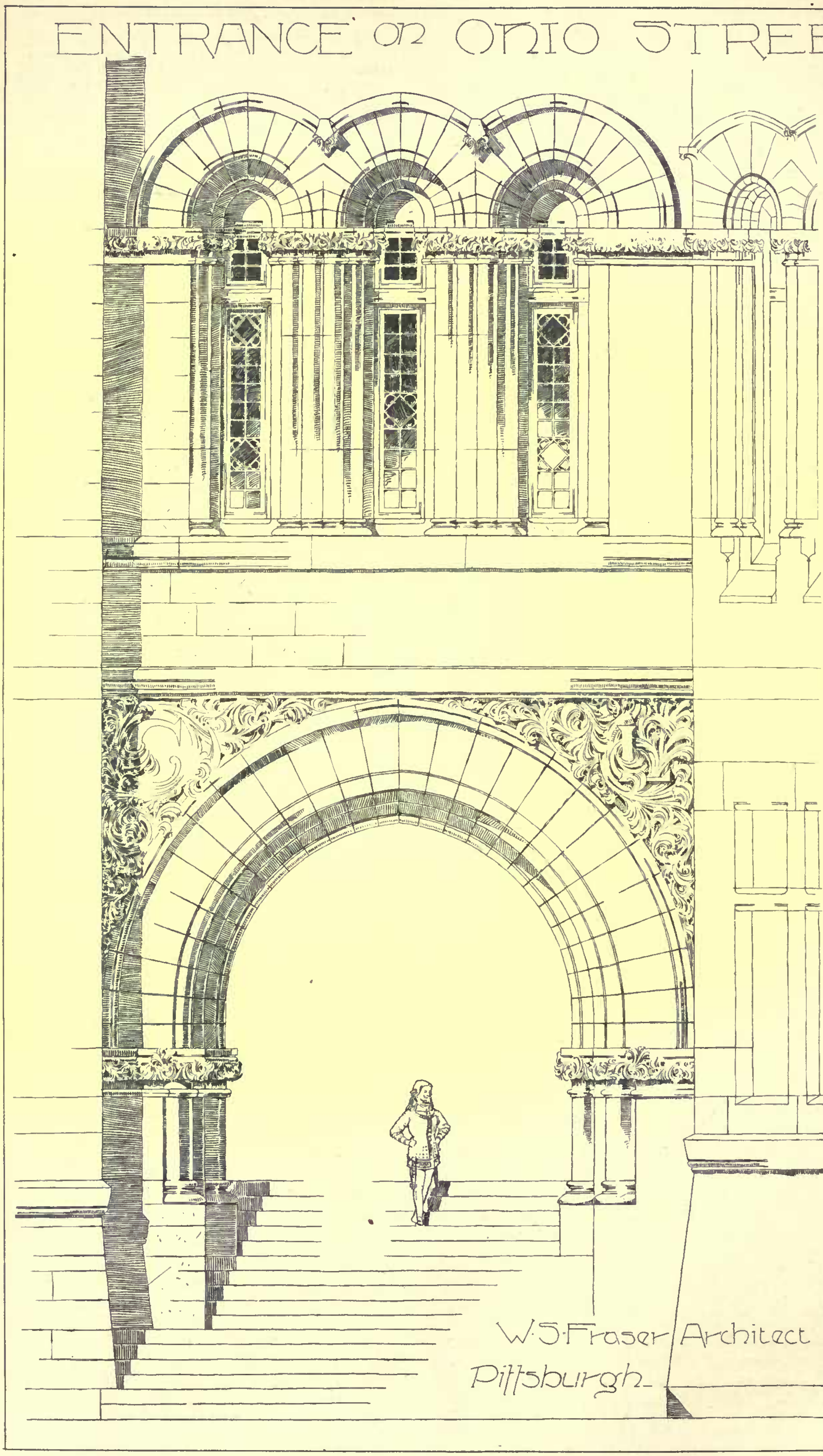
The Convention then adjourned, to meet informally at Professor Ware's quarters, in Columbia College, the same evening.

First Day, Afternoon.—During the afternoon the visiting architects, under the guidance of resident members, visited, in groups, various structures of note, recently erected, beginning with that in which the Convention was held.

First Day, Evening.—In the evening there was a large attendance of visiting and resident members at the Architectural School in Columbia College, where they were informally received by Professor Ware. Scattered throughout his rooms, on the walls and tables, were recent designs from the office of the Supervising Architect of the Treasury Department, in Washington, and the competitive drawings for the Kansas City Chamber of Commerce. There was also a considerable collection of photographs of domestic architecture in the Bermudas, selected by Mr. Bloor during two visits to those islands.

Mr. Moser, with characteristic humor and ingenuity, produced on the blackboard some grotesque diagrams, to show that the cut of clothes worn by Englishmen, Frenchmen and Germans is differentiated by their national characteristics. His clever lines reminded one of Cæsar Daly's half-serious and half-jesting illustrations, in one of the early copies of the *Revue Générale*, in support of the theory that the style of roof prevalent in a nation is evolved from its usual head-dress.

[To be continued.]

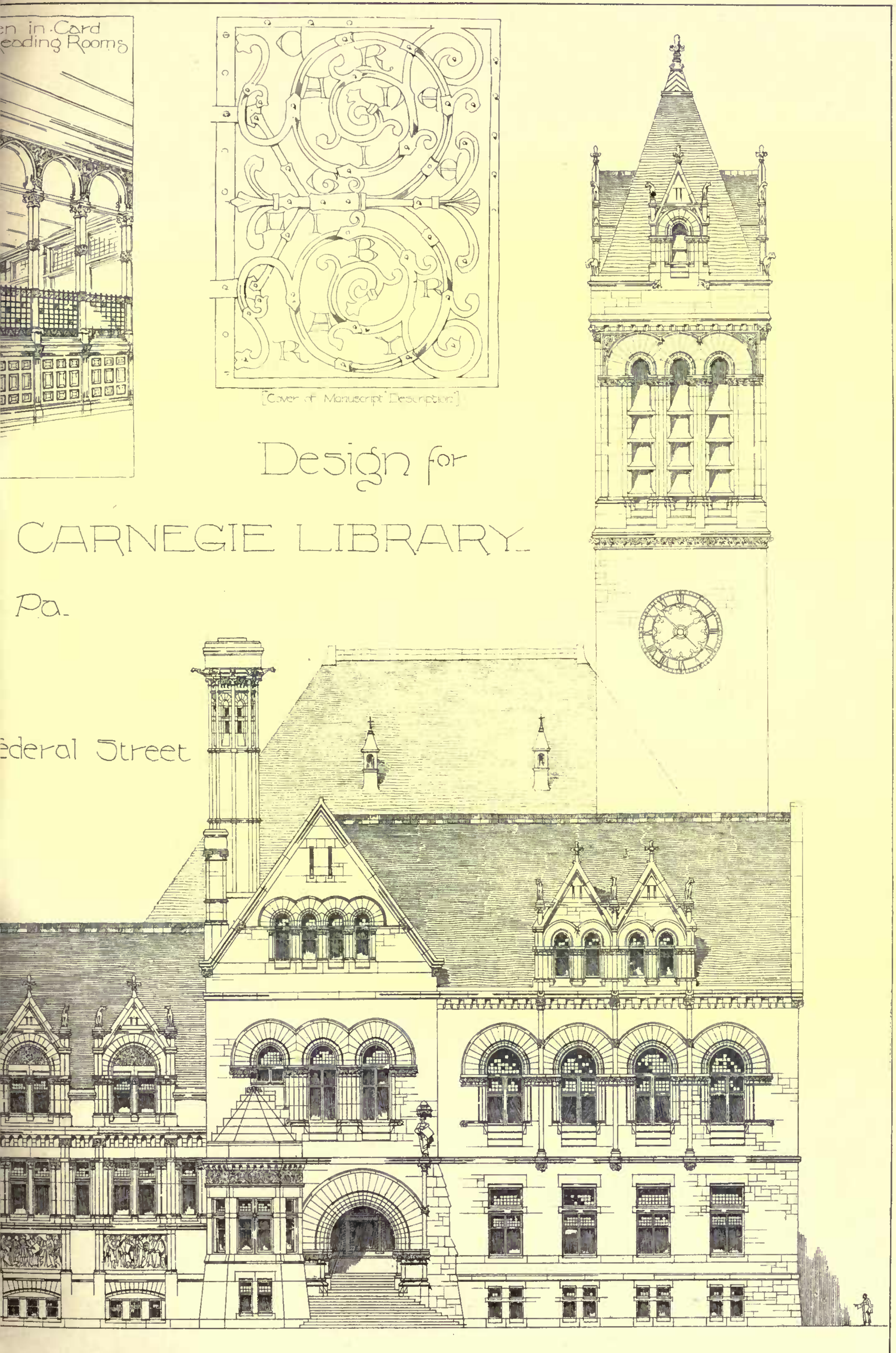


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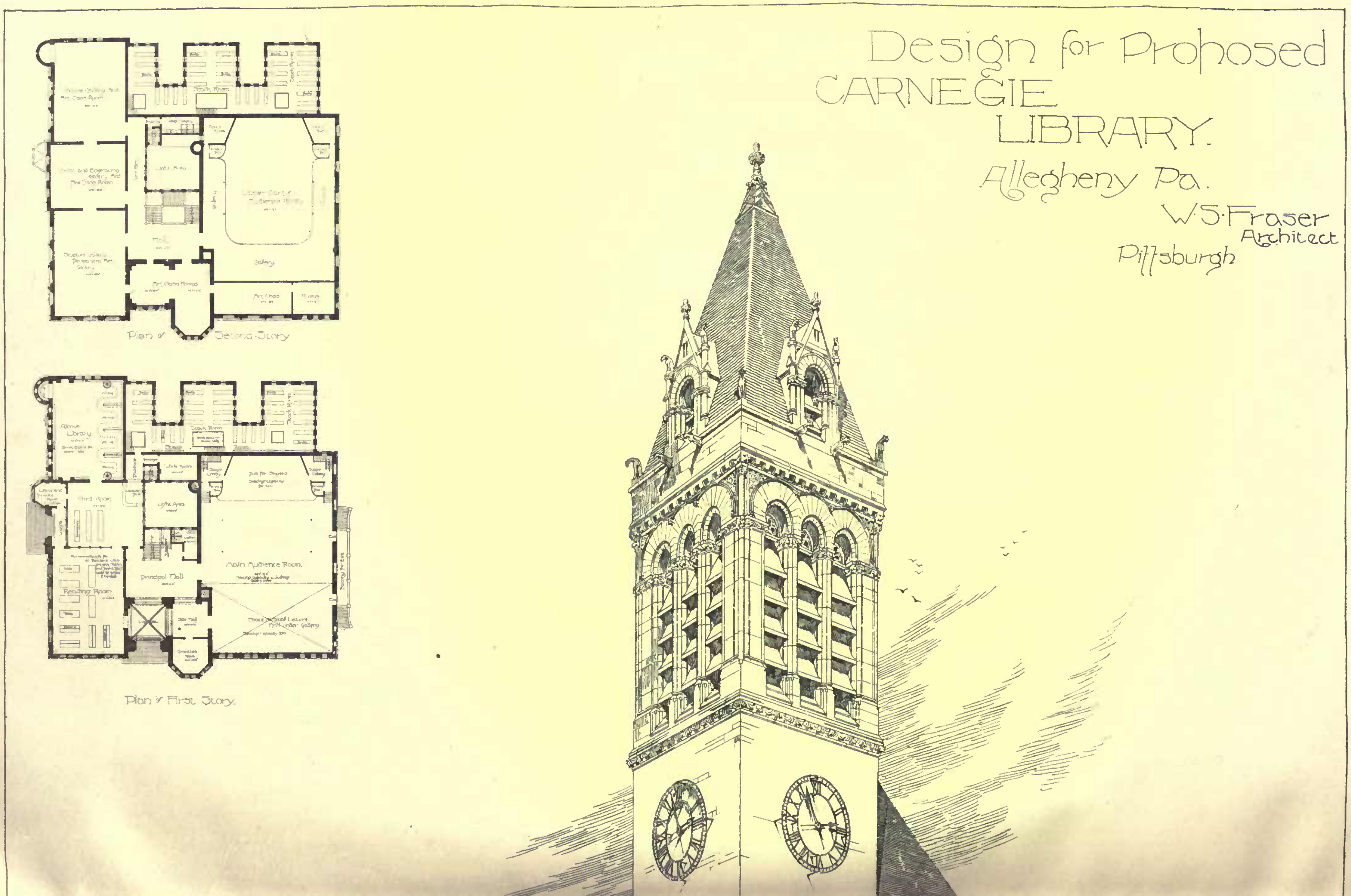
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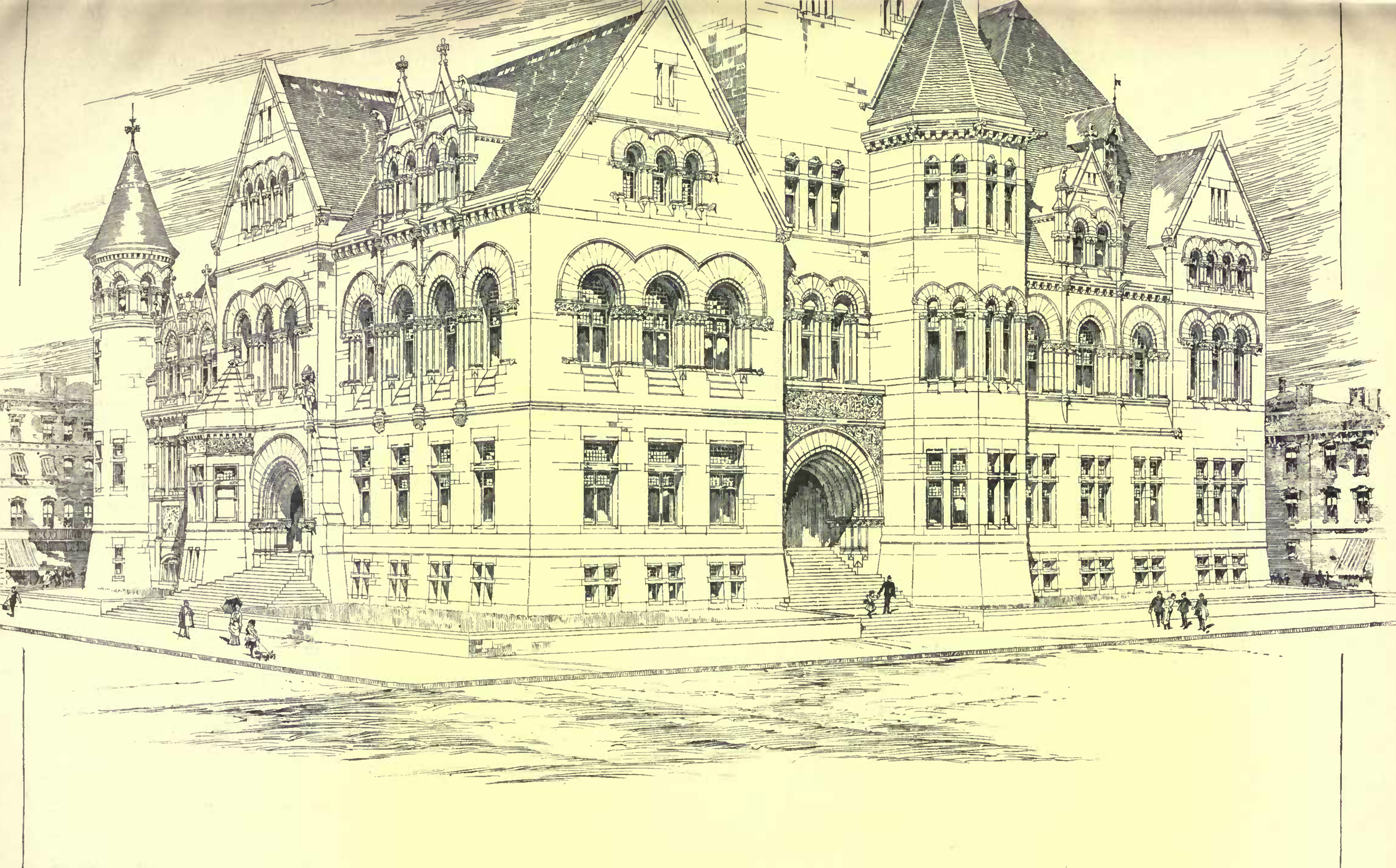
Elevation





Heliotype Printing Co Boston


Design for Prohosed
CARNEGIE
LIBRARY.
Allegheny Pa.
W. S. Fraser
Architect
Pittsburgh
Plan of Second Story
Plan of First Story
Main Audience Room.
Principal Hall
Reading Room
Alcove Library
Stack Room
Light Area
Gallery



Heliotype Printing Co. Boston

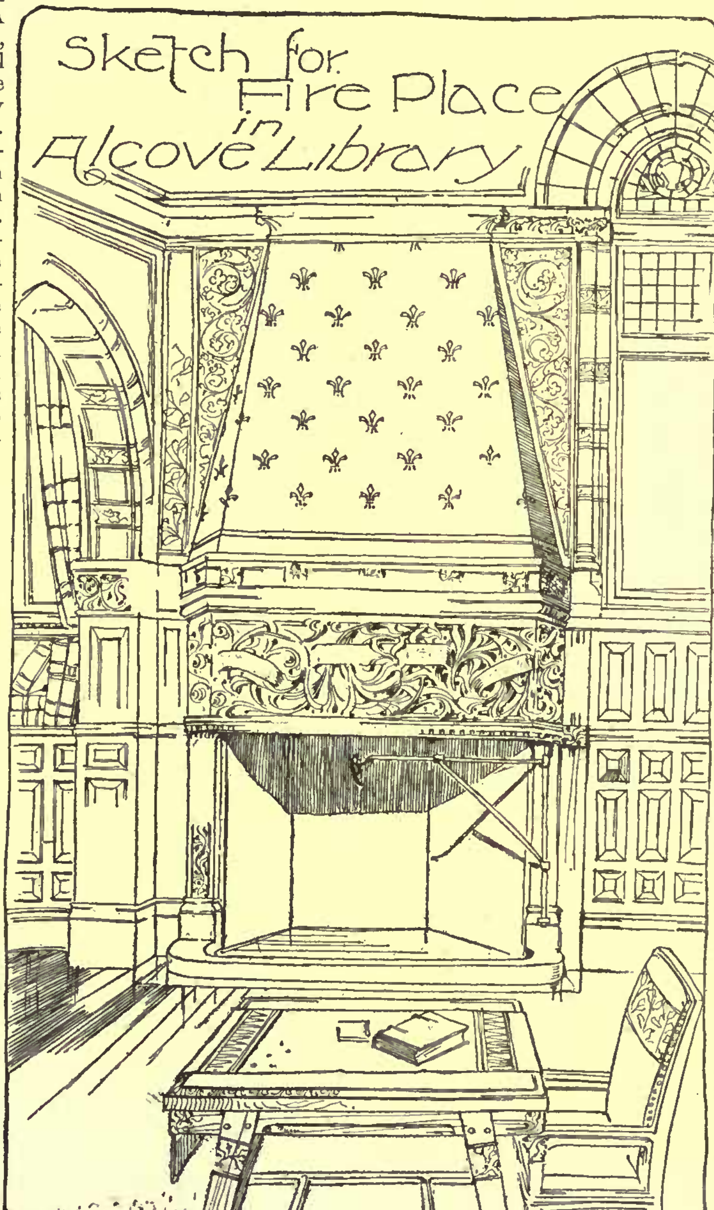
ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE GREEK GALLERY OF THE MUSEUM OF FINE ARTS, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial Edition.]

THE bas-reliefs of the Temple of Apollo Epicurius (the Helper), in Phigalia, near Bassæ in Arcadia, now in the British Museum, from which the casts shown in the frieze of this room were taken, consist of twenty-four slabs. The temple was built by Ictinus, the architect of the Parthenon, about 430 B. C., and the marbles are said to have been sculptured by Alcamenes, who, after working for a time with Phidias, is represented in history as his competitor. A certain monotonous character, which strikes us in the general aspect of this frieze, is due to the subject, which admits of variety only in the matter of grouping. Variety is only possible to a limited extent in the representation of a series of struggles between Greeks, Amazons, and Centaurs. To attain it the sculptor has introduced such episodes as the bestowal of care upon the wounded, the representation of the dying Amazon sinking to the ground, etc., and has thus often created a happy opposition which heightens the interest, and gives an increased effect of energy to the fighting groups. In the battle of the Amazons, the figure wearing a lion-skin, who is about to strike an Amazon, is recognized as Theseus. The national hero of the Greeks again appears in the battle of the Centaurs, near a tree upon which hangs a lion-skin. There also are Apollo, shooting an arrow from his bow; Artemis (Diana) as a charioteer, driving a pair of stags; and Caneus, beating down a Centaur to the earth.



On the left is a cast of Mausolus, colossal statue in the British Museum, found at Halicarnassus by Mr. Charles Newton, in 1857, on the site of the mausoleum erected by Artemisia to the memory of her husband, Mausolus, Prince of Caria, who died in the 107th Olympiad (B. C. 353). This splendid edifice, which was classed as one of the seven wonders of the world, consisted of a square podium or base, four hundred and sixteen feet in circumference and between thirty and forty feet in height, surrounded by an Ionic peristyle.[1] Its four sides were decorated with sculptures by Scopas, Leochares, Timanthus, and Bryaxis, and from its centre rose a truncated pyramid, on the top of which stood a marble chariot drawn by four horses (*quadrigæ*) bearing the figures of Mausolus and Artemisia, or a goddess, as the companion statue is sometimes called. This group was sculptured by Pytheas or Pythis, as we learn from Pliny. The statue of Mausolus is evidently a portrait treated in the heroic style, and the face has a singularly modern appearance, owing to the mustaches, the closely cut beard, and the short hair. Mr. Newton conjectures that the left hand was slightly advanced, and rested on a sceptre. The monarch looks as he describes himself in one of Lucian's Dialogues (*D. Mort*, XXIV.), "a tall, handsome man, formidable in war." He is draped in an ample mantle, under which the chiton is seen upon his breast.

The three small casts on the left, directly under the frieze, are reliefs from the mausoleum at Halicarnassus, now in the British Museum. Of the three distinct friezes dug up by Mr. Newton, at Halicarnassus, one represents Greeks and Amazons fighting; another the battle between the Centaurs and Lapithæ; and the third a chariot race at the funeral games celebrated in honour of Mausolus. These reliefs are from the first series. In action they resemble the Phigalian marbles shown in the casts above.

The cast in the corresponding position on the other side of the doorway, is a metope, found in the Troad, by Dr. Schliemann. The bas-relief, representing Helios (the sun) guiding his chariot, dates probably from the fourth century B. C.

The Greek vase, at the left of the doorway, is from the Royal Museum of Naples.

The head of Medusa in alto-relief, from the Glyptothek at Munich, called the Rondanini Medusa — after the Roman family in whose possession it remained until 1803, when it was bought by Prince Louis of Bavaria for 4,000 scudi — has been said to be a work of the time of Alexander the Great, on account of the free treatment of the hair; but if so, the sculptor was one who held fast to the traditions of a more ideal theory of art than that of the school of Lysippus. More elaborate in detail, less generalized in form than works of the school of Phidias, it has that same sort of noble beauty which marks the Ludovisi Juno. It corresponds to the interpretation of the myth of Perseus, which makes the Medusa head symbolic of the phenomena of nature. Medusa is the starlit night, solemn in its beauty, and doomed to die at the rising of the sun (*i. e.*, Perseus), while her sisters, the Gorgons, represent total darkness, impenetrable to the sun's rays. In the realistic Medusa type, the face is round, like the full moon, the eyes protrude, the ears are large, and the enormous mouth is armed with sharp fangs. In the idealistic Medusa, of which the Rondanini head is an example, the face is solemn with the solemnity of death, and fascinating in its terrible beauty. Cheerless and sad, stony in its fixed repose, it is like Lamia at the feast, —

> "Some hungry spell that loveliness absorbs,
> There is no recognition in those orbs."—*Keats.*

On the extreme left are shown Castor and Pollux carrying off the daughters of Leucippus, king of Sicyon; bas-relief on a Sarcophagus in the Vatican, in style approaching that of the Phigalian Marbles.

Just above this is a cast of the Vienna sarcophagus, in the Belvidere Palace at Vienna. This famous sculpture is said to have been brought from near Ephesus by Count Fugger, after the battle of Lepanto in 1571. It represents a contest of Greeks and Amazons, and in style as well as subject greatly resembles the frieze of the Mausoleum, from the neighboring city of Halicarnassus.

The large cast on the left is the Barberini Faun, from the Glyptothek at Munich, and was found in the immediate neighborhood of Hadrian's Mausoleum (the Castle of St. Angelo) during the pontificate of Urban VIII (1623–44), and placed in his family palace, that of the Barberini. In 1813 the Crown Prince of Bavaria bought it for 8,000 scudi. It is universally allowed to be an original Greek work, not older than the time of Alexander. Winckelmann supposed that it was one of the statues upon the exterior of the mausoleum, which were hurled down upon the Goths when they besieged it in the sixth century (A. D. 527). Wrapped in profound slumber, the tired Faun, every part of whose huge frame is instinct with life, reclines in an eminently natural and characteristic, if not a noble attitude.

Opposite, on the right hand, is a cast of the Fighting Gladiator, now in the Louvre, which was found at Porta d' Anzio (the ancient Antium) in the early part of the seventeenth century. It was purchased for the Louvre, from Prince Borghese, in 1808. The right arm and the right ear have been restored. A shield was held in the left hand, which still grasps its ring-like handle. The figure has

[1] The tombs of Alyattes at Sardis, and of Porsenna at Clusium (Chiusi), which were also cubes or circles supporting pyramids, were developed out of the tumuli of the heroic ages. They furnished the type of the mausoleum, as it did that of the mausoleums of Augustus and Hadrian at Rome, which, like all great Roman sepulchres, were called mausolea, from the mausoleum of the Prince of Caria.

been erroneously called Achilles and Theseus, though the head is too realistic to be that of a hero or demigod. It represents a warrior fighting in an attitude calculated to display bodily action with full effect. This end was aimed at in the later Greek schools, and, as we learn from the inscription, the statue was made by Agasias, son of Dositheos of Ephesus, who flourished about B. C. 176 (Ol. 150).

On the left in the next room is a cast of the Venus of Milo, the celebrated statue found in 1820, by a peasant named Yorgos, in a subterranean tomb or grotto near Castro, a village of the island of Melos. The Count de Marcellus, French Envoy at the Ottoman Court, purchased the detached fragments and brought them to Paris in 1821. The figure is composed of five pieces of marble, namely, the bust with the head, the draped legs, the two hips, and the "chignon." The great toe of the right foot and the whole of the left foot are restored in plaster. The Count de Clarac, who was Director of the Louvre when the Venus arrived in France, has left a description of a plinth which came with it, upon which an inscription recorded the name of the sculptor Agesandor, son of Merides, a citizen of Meander, a town in Caria. The plinth cannot, however, have belonged to the Venus of Milo, as the town of Meander was not founded until B. C. 261, when art was in too decadent a state to allow us to suppose the production of such a masterpiece possible. It would seem to belong to such a school as that of Scopas, which stood midway between the Phidian, whose idealism was tinged with a modicum of archaic severity, and the Praxitelean, in which all trace of archaism was lost in grace and sensuous beauty. Scopas, contemporary of Philip of Macedon, blended the pure idealism of Phidias with a noble materialism in works distinguished for such lofty grandeur of style as we find in this goddess, and such dramatic power as is coupled with it in his Niobe.

When the statute was taken from the place where it had been hidden during the Commune, it was found that the dampness had caused the upper and lower halves of the figure to separate. The fact was then discovered that a wedge had been inserted between the two parts, which caused the upper half of the body to incline forward out of its proper position. This was removed by M. Ravaisson, the present Director of the Louvre, and the beauty of the statue manifestly increased.

The casts shown against the rear wall of the gallery form the central group of figures from the western pediment of the Temple at Olympia, by Alcamenes. In this pediment the sculptor represented the struggle between the Centaurs and the Lapithæ, which followed after the attempt of the drunken Eurytion to seize Deidameia, the bride of Peirithoös, at the wedding feast. The colossal male statue, which forms the apex of the composition, represents Apollo in a sufficiently archaic style to distinguish him from the mortals around him.[1] He either held his attribute, the laurel branch, or the Ægis, in his right hand, and presided over the battle as a symbol of divine impartiality, like Athena in the pediments of the Temple of Ægina. The group to the left of Apollo represents Deidameia struggling to free herself from the arms of a Centaur. Mr. Newton calls it "a master work of Athenian art."—*Extracts from the Catalogue.*

COMPETITIVE DESIGN FOR THE CARNEGIE LIBRARY, ALLEGHENY, PA. MR. W. S. FRASER, ARCHITECT, ALLEGHENY, PA.

[WE adopt the very unusual course of devoting all the illustrations of this issue to a single design—and that, too, not the successful one—submitted in a recent competition. But since, *comme dessins* to say the least, the work is of unusual excellence we believe that we shall not be too severely chidden.]

In the preparation of this Design the Author has endeavoured to follow the Instructions and to provide substantially the accommodations asked for, while availing himself of the liberty accorded to the Competitors to suggest variations as to additional rooms and their location. Some minor changes have been made and several rooms added which will be described more fully hereafter.

It appeared to him to be a matter of vital importance to so arrange the rooms that economy in time required for serving readers would be

[As the foregoing sample page is enough to indicate the style in which this description was prepared for the Committee's use, we will print the rest in ordinary type.]

combined with such positions that complete supervision to each visitor could be given from librarian's desk. He has, also, so placed Alcove Library that all visitors will have to pass directly before librarian or his assistants to leave or enter it.

The author had given so much thought to the arrangement of the various rooms and the elevations, before the Committee issued their second circular letter regarding reduction in seating capacity in large hall, that he concluded to complete the plans as begun, believing the change to be optional. The author has also exceeded the instructions of the committee and has elevated the building ten feet above lot line, thus giving greater dignity to the building and preventing the possibility of the effect of the library being spoiled at any time by high edifices being erected in the immediate vicinity. It was also thought best, after mature deliberation and study, that a serious mistake would be made in erecting one-story buildings on an enclosed city lot closely surrounded by high business houses, as it would lose the very effect desired in a public institution, *i.e.*, dignity and leadership. The plan is so arranged that should the committee desire, it can be reversed and the Federal-street front be made to face Ohio Street, and *vice versa*, without altering the plan in any particular excepting position of rooms. The principal entrance has been made on Ohio Street. Entering through it a visitor would find himself first in a spacious lobby. Leaving this the principal hall opens before him with the grand staircase directly in front. This hall will be amply lighted by means of a light area of large dimension, which assures abundance of light. Then if he desires to use the library portion of the building, he turns to the left and enters direct into the reading-room; or, passing to the left of the staircase through an ample passage-way, enters the card or catalogue room. Or should he design to enter large or small hall he would turn to the right. The art-rooms would be found directly at head of grand staircase. The reading-room is larger than asked for by committee (as are all rooms excepting large audience-room). The windows are a special feature of this room, being constructed so that light will be thoroughly diffused over entire room. Between this room and card-room is an open ornamental screen serving the dual purpose of helping light card-room, and also giving librarian supervision of reading-room from his desk, while room is separate and distinct from card-room. There is also an entrance to this room from Federal Street. As more people will use this room than any other, it was thought best to give it due prominence both in position and means of entrance and exit.

Connecting and part of this room is the card or catalogue room, with the librarian's desk at one end. At first glance it would seem that this room would be dark, but when one considers the light that would be given by large light area, and through loggia on Federal Street, and through the open screen from reading-room, it can be seen that the light could not possibly be improved upon. The card-room is so placed that it can be used equally from either reading-room or alcove library. Opening from this room is the librarian's private office, with outside entrance, so that he can enter or leave without passing through public part of library, and also be within ready call from his assistants who may need him at desk. The alcove library and its position needs no explanation, as it will be seen at once that this, being a room where reference-books will be kept, perfect quiet and retirement are the first and greatest objects. This room, like all others, is somewhat larger than asked for, but the author found the space could be had and thought none would need it so much as this room. It will be seen that fireplaces are designed for this room (see drawing in report). The author's reason for so doing was to make it as home-like as possible, as reference-searchers

[1] Dr. Treu, who follows Pausanias in supposing this figure to be Peirithoös, suggests that he held the Ægis in his right hand, and with his left grasped a Centaur by the hair.

often have to remain for days to perfect their studies, and it should be more cheerful than rooms where the occupants are hourly changing. At the rear of the librarian's desk, and so near that it may be said the two are almost one room, is the stack-room in which it is intended to have all the latest improvements, as glass floors, etc. The author has not shown any of the purely technicalities on his plans, as any competent architect, with an intelligent building-committee, can easily arrange for matters of that kind when drawing out the working-plans. It is intended to have the stack-room two stacks high, but should more space be required, very little extra expense would be entailed in providing for another stack in height, adding one-third more books. The working-room and private stairway to second story and basement are open from the passageway back of desk. The work-room is thus brought near to stack-room and desk.

There are many small matters the author would like to call the attention of the Committee to, but the plans are so plain they can easily be discerned. The committee-room beside Ohio-street entrance, and small hall for lecture and music hall, complete the first floor. The basement has been divided into class-rooms, store-room, boiler-room, heating-chamber, lavatories for employés and for public, also waiting-rooms for singers, These rooms can be entered from back of building. In heating it is intended to use the fan system both for heating and ventilation. Space will not permit author to explain what most of the Committee are perfectly familiar with, in this system, one now generally used in best public edifices. Two stacks for heating and ventilating have been provided, but more can be added if necessary, although author thinks they are ample. Items of this nature are matters for future detail and study. The second story and part of the third, apart from gallery for main audience-room, have been set apart for a free art school and galleries. The author remembers with gratitude several years in which he spent all his evenings in Cooper Institute, New York, gaining free an education which he could not otherwise have obtained; and for the sake of the poor boys who crave an art education, in our vicinity, would respectfully ask that the Committee, even though they do not adopt his plans, would consider a school of this kind in connection with the institution they are about to organize, for of how much more use are books to those who have the necessary education, artistic and scientific, to apply them practically. These are about the only cities of any magnitude where the youth without means have no possible way of receiving a higher education of a practical nature. And an enduring monument would be the result of such a school. How often has the author heard poor boys in New York speak, with tears in their eyes, of the longing they had to show in some manner the gratitude they felt for Peter Cooper.

The remaining rooms in third story have been devoted to a dwelling for the janitor, giving him a spacious residence, thus assuring a better class than would be willing to be cramped in one or two small rooms in some out-of-the-way place. The style chosen for the design is the early French-Gothic with an Early English feeling. This style is a little later than the Romanesque so much used, and is the refinement of that style, which, though bold, yet does not possess that refinement which one desires in an acquaintance you must meet every day. The features are just as bold and more picturesque than the Romanesque. The carving is not meant to be executed as finely as shown on drawings, but the effect will be what is shown in reality. The author has made a careful estimate in detail, calling to his assistance practical men of large experience, and finds the cost of executing his plans would exceed the amount allowed by some twelve thousand dollars, namely, two hundred and sixty-two thousand dollars ($262,000). But as this is what is called for in first circular, he still believes that the plans are within the sum specified. The plans and this report are now respectfully submitted, with the full faith that the Committee will give them due study necessary to discover what has taken the best hours of the author, for the entire period elapsing since the first circular was issued; and he would remark that for nearly ten years he has worked on few but public buildings, both in New York and in London, of the largest magnitude, and consequently feels competent to carry out to the Committee's full satisfaction the building in its entirety.

THE BEST TWENTY BOOKS FOR AN ARCHITECT'S LIBRARY.



COUPLED CAPITALS IN THE CLOISTER VAISON.

FROM REVOIL.

SO long a time has elapsed since we asked our readers to submit lists of "the twenty books that an architect can least afford to be without," that probably the fact has been forgotten even by those who took the trouble to prepare an answer. The matter has not been overlooked by us, however; but the replies straggled along for such a length of time — in fact, we have received two within the past fortnight — that we could not feel sure till now that we had received all the replies that were likely to be made.

If we had realized what a difficult question we had propounded for solution, or had formed any idea of the task that the comparison and collation of the data contained in more or less incomplete forms in the lists submitted would devolve on us, we assuredly would not have undertaken the job — no other word can adequately express our feelings.

We are profoundly grateful that we received comparatively few lists; but this does not at all interfere with the feeling of obligation that we entertain toward those who prepared the lists, particularly those on which much time and careful consideration were bestowed.

We received replies from ninety-nine individuals, only forty-nine of whom furnished lists, the others confessing that though they had much interest in the result of the enquiry, they found it impossible for one reason or another to decide what books should be included. In these forty-nine lists, two hundred and ninety-two separate works were mentioned, and we shall give in due time the entire list; because it must be borne in mind that each one of the books named is of such value that some one or more architects would include it in his small library of twenty selected books. The entire list, or at least two hundred of them — as the balance will be found to be, as it were, simply variations on the themes of the two hundred — would form a tolerably complete and very valuable library for any individual or association. One of the lists was a very model of brevity, and, shall we say? good sense: it was simply "the twenty volumes of the *American Architect*." This leads us to observe that the place on the list held by the *American Architect* would probably be parallelled by that of any other journal whose editors should extend to its readers a similar suggestion to that which has occasioned the expression of esteem so flattering to this journal.

We give below the list of the twenty works that received the highest number of votes, and though they represent the opinions of only forty-nine men, they have just forty-nine times the weight that have the answers we so often have to make ourselves to questions as to the best book on a given subject.

The list forms a fairly-balanced library in itself, as it contains one history, one encyclopædia; two architectural dictionaries, one general, one special; two architectural journals, one American, one foreign; one work on decoration; one on heating and ventilation; one on steam-heating; one on architectural styles; one on perspective; one on limes; one general treatise; and two on construction. Two of the three "pocket-books" need to be replaced by works on sanitation and on iron. One specimen of Ruskin's writings will serve, the other should be replaced by a work on mechanics, and "*Webster's Dictionary*" could be usefully displaced by a treatise on graphic statics.

It will be noticed that the list given below contains twenty-one works, because the last five named received the same number of votes. It is also to be remarked, that if the votes thrown for the three pocket-books had been united on one of them this would have led the list, and proved what we believe to be the fact, that a good *vade mecum* is the most *useful* of all works.

LIST OF THE BEST TWENTY BOOKS FOR AN ARCHITECT'S LIBRARY.

I. FERGUSSON, JAMES. 33 votes.
"*The History of Architecture in all Countries.*" 2 vols
New York: Dodd, Mead & Co. 1883. $7.50

II. GWILT, JOSEPH. 28 votes.
"*An Encyclopædia of Architecture.*" 1 vol.
London: Longmans, Green & Co. $17.00 to $20.00.

III. "*The American Architect and Building News.*"
Boston: Ticknor & Co. $10.00–$7.00–$6.00. 28 votes.

IV. VIOLLET-LE-DUC, E. 19 votes.
"*Dictionnaire raisonné de l'Architecture Francaise, du XI au XVI Siecle.*" 10 vols.
Paris: A. Morel & Cie. 200 to 250 francs.

V. SMITH, COL. 19 votes.
"*Notes on Building Construction.*" 3 vols.
London: Rivingtons. 1875. $13.00.

VI. TRAUTWINE, J. C. 17 votes.
"*Civil Engineer's Pocket-Book.*" 1 vol.
New York: John Wiley & Sons. $5.00.

VII. CLARK, T. M. 16 votes.
"*Building Superintendence.*" 1 vol.
Boston: Ticknor & Co. $3.00.

VIII. VIOLLET-LE-DUC, E. 15 votes.
"*Discourses on Architecture.*" 2 vols.
Boston: Ticknor & Co. $15.00.

IX. JONES, OWEN. 14 votes.
"*The Grammar of Ornament.*" 1 vol.
London: Day & Son. 1856. $25.00.

X. ROSENGARTEN, A. 12 votes.
"*Hand-book of Architectural Styles.*" 1 vol.
London: Chatto & Windus. $4.00.

XI. KIDDER, F. E. 11 votes.
"*Architect's and Builder's Pocket-book.*" 1 vol.
New York: John Wiley & Sons. 1885. $3.50

XII. WEBSTER, NOAH. 10 votes.
"*An Unabridged Dictionary of the English Language.*"
Springfield, Mass.: W. & C. Merriam.

XIII. RUSKIN, JOHN. 8 votes.
"*The Stones of Venice.*" 3 vols.
New York: J. Wiley & Sons. $4.50.

XIV. GILLMORE, J. Q. A. 8 votes.
"*Practical Treatise on Limes, Hydraulic Cements and Mortars.*" 1 vol.
New York: D. Van Nostrand. 1875. $4.00.

XV. WARE, W. R. 8 votes.
"*Modern Perspective.*" 1 vol. Plates in portfolio.
Boston: Ticknor & Co. $8.00.

XVI. BALDWIN, W. J. 8 votes.
"*Steam-Heating for Buildings.*" 1 vol.
New York: John Wiley & Sons. $2.50.

XVII. "*The Builder.*" 7 votes.
London: 1843–86. $6.33.

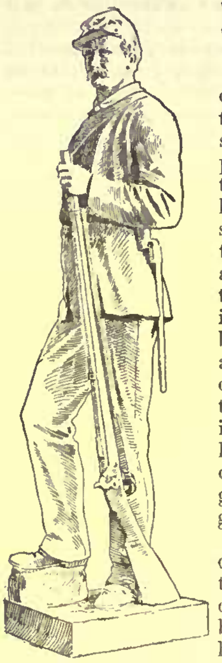
XVIII. HASWELL, C. H. 7 votes.
"*Engineers' and Mechanics' Pocket-book.*" 1 vol.
New York: Harper & Bros. $4.00.

XIX. BILLINGS, J. S. 7 votes.
"*Ventilation and Heating.*" 1 vol.
New York: *Sanitary Engineer*, 1884.

XX. RUSKIN, JOHN. 7 votes.
"*The Seven Lamps of Architecture.*" 1 vol.
New York: John Wiley & Sons. $1.75.

XXI. PARKER, J. H. 7 votes.
"*Concise Glossary of Architecture.*" 1 vol.
Oxford and London: J. Parker & Co. $6.00. 7-6

THE REMOVAL AND DESTRUCTION OF ORGANIC WASTES[1]. — II.



THE process to be adopted, where suitable facilities are available, is one of the following:

1. To deliver the whole mass into a river or body of water sufficient not only still further to dilute it, but to furnish the abundant supply of oxygen needed for rapid and complete decomposition. This may be supplied by the air contained in the water, and capable of being rapidly renewed by absorption at the surface. The process will be greatly facilitated under ordinary circumstances by the action of fish, shell-fish, aquatic insects, and the various minute organisms which abound in all bodies of water. What is not consumed by these becomes the means of subsistence and of the rapid development of the micro-organisms, the bacteria of putrefaction and the bacteria of nitrification among others, and is rapidly resolved into its elements, susceptible of removal in solution in the stream, and of becoming the pabulum of seaweeds, eel-grass, "green-scum" and other vegetable growths.

2. To deliver it over the surface of land capable of absorbing it. Here the coarser particles remain on the surface, becoming, to a considerable extent, the food of insects and of birds, being destroyed by putrefaction, and being dessicated by exposure to the air, or in winter broken up by frost. By far the larger portion, and much the worst portion, being fine particles in suspension or soluble matters in solution, is carried by the water into the ground, and is filtered out of the flow by the earth through which it passes, the water descending, after a certain distance relieved of all its organic burden, and becoming pure save for the dissolved elementary matters which it may have taken from the soil.

3. To discharge it on the surface of very porous, sandy or gravelly ground, drained naturally or artificially at a great depth, securing the effect of the system of irrigation just described, but in a much more concentrated form, ten or even twenty times the volume of sewage being applied to a given area in this case more than in the other. In both of these methods of soil-treatment the deposited organic matter is destroyed by bacterial action.

(There are certain chemical processes which may be used in emergency. They are rarely, if ever, worth considering in this country.)

The three processes indicated are, all of them, capable, under proper circumstances, of being made absolutely inoffensive and effective, but they are also capable of being made intolerable and dangerous nuisances. If the volume discharged into a stream or into a harbor is greater than it is capable of taking care of, the accumulation of surplus soon decreases its efficiency, the surplus increases in proportion, and in a short time the water becomes so overstocked with impurities as to defeat the whole scheme. The system of broad irrigation, if the area of land is sufficient for it, if it is sufficiently well drained and aerated, if the flow over its surface is so regulated as to prevent accumulation in gullies and depressions, if the ground is not permitted to become hardened and made impervious, and especially if effective cultivation is carried on, is not only available for all time, but the soil will, by the accumulation of a greater supply of bacteria, and by the improvement of the conditions needed for their growth, become, with time, more and more effective.

By the method of more intensified filtration, the third method described, less account is made of the value of the sewage as a fertilizer, the leading object being the purification of a large volume by a small area of land. This, too, requires to be properly adjusted to the work to be done. When properly adjusted the result is in all respects satisfactory. If, however, from lack of proper drainage and aeration, or from the too long-continued use of any part of the field, the easy filtration of the sewage into the soil, or the easy access of air to the interior spaces, is prevented, a nuisance of considerable magnitude would be created.

The principle which underlies successful purification, whether by application to the land, by broad irrigation, or by intensified filtration, is that there should be an intermittence of application. A certain dose of foul matters having been deposited on the interior surfaces of the soil, the irrigation must cease, and an opportunity must be given for air to enter the soil freely. The bacteria then continue their development, by consuming the crude matters, a process which involves the combination with them of the oxygen of the air. When their work is done, everything of an organic character is disorganized, the nitrogenous matters are resolved into nitrates, and generally the elements contained are set free in a condition suitable for removal by water in solution, or for use by crops growing on the land. The element of intermittence is absolutely essential in the case of intensified filtration, hence the term "intermittent filtration," and it is equally essential that the delivery of sewage in broad irrigation be not so concentrated at any point as to prevent reasonable aeration.

The conditions under which these systems may be applied are almost as various as are soils and locations, it being understood that peat and clay are the worst materials, and sandy and gravelly soils the best; the difference between the two classes being much more important in the case of filtration than in the case of irrigation. In irrigation, the amount of land required to receive the sewage of a given population is very much greater with heavy soils than with light ones, but if sufficient area is available, even the heaviest clays can be made effective for the work. In filtration, a considerable degree of permeability is absolutely necessary, and where only heavy clay soils are available, it is necessary to secure a permeable condition by costly artificial improvement.

No matter what the character of the soil, unless it is well drained naturally, it should be very thoroughly underdrained to a depth of four or five feet, and better of six or eight feet.

There is in the application of all these systems no mystery nor complication. Indeed, by the method that has been set forth the best permanent results can, by one process or the other, be easily secured under nearly all circumstances.

It is important to remember that the destruction of organic wastes by bacterial action takes place almost exclusively, and much more actively, very near to the surface, that is, close to the atmosphere whose oxygen is as important to the growth of the bacteria as is the organic matter on which they feed.

This indicates the importance of one feature of the work which has not been sufficiently recognized in practice: that is, that all manner of organic refuse should be kept out of the deeper soil. If sewage matters are delivered, as by the leakage of drains or cesspools at a considerable distance below the surface of the ground, the organic matter contained can no longer be destroyed by the methods indicated. It becomes, then, subject to processes of decomposition quite different from putrefaction and nitrification, and the results, instead of being entirely harmless, are liable to become seriously pernicious.

The investigations thus far made as to the various processes of decomposition have not been carried far enough to indicate with scientific accuracy the degree to which the decomposition of sewage in deep soils is effected by the absence of a liberal supply of air; all that can now be said is, that there are indications, and in some respects very strong indications, that the tendency to the formation of pernicious products of fermentation, and to the fostering of injurious micro-organisms, including perhaps the germs of zymotic diseases, is greatly favored by the absence of air and greatly hindered, if not overcome, by sufficient exposure to air.

Experience gained in biological studies at the office of the Surgeon-general in Washington demonstrated very clearly the avidity with which the *bacterium termo* takes possession of gelatine preparations to which it obtains access. It was found that in cultivating specific germs, by Koch's method of seeding in lines, many organisms, taking root on the field, grew independently and without encroaching materially on those under observation; but if the *bacterium termo* chanced to gain a foothold, it rapidly occupied the whole field, apparently destroying and consuming all other growths. If it is prudent to draw deductions from such incomplete observation, it may be inferred that putrefaction is a valuable disinfectant, and may become our best ally in destroying germs near the surface of the ground which safely follow streams of sewage flowing at a considerable depth where putrefaction cannot become active for want of air.

It will be seen, on due consideration of the ideas that have been set forth in this paper, that what is suggested is, from the start within the house to the final disposal at the irrigation field, or in the river, very different in its basis from ordinary systems of removal and disposal, and radically different from all systems of conservancy. This latter process, which is still the process in use by at least ninety-five hundredths of all the domestic wastes of Christendom, depends for its efficiency on conditions under which restricted and imperfect decomposition, taking place in the absence of sufficient aeration, is an inevitable accompaniment.

By the methods suggested conservancy is absolutely discarded. Instant removal of all matters as fast as produced is the essential feature of local drainage, and exposure to conditions which will ensure speedy destruction by active putrefaction, is the efficient and complete means of final disposal.

[1] Portions of the annual address delivered before the Medical and Chirurgical Faculty of the State of Maryland, at Baltimore, Md., by George E. Waring, Jr., and published in the *Transactions* of the Society. Continued from No. 579, page 58.

Altered Specifications. — The facts in the case of Olmsted *vs.* Angus & Dallas, in which the jury yesterday found for the defendants, are as follows: Mr. Olmsted offered certain specifications for his proposed new residence to Angus & Dallas, upon which they were asked to bid. They did so in writing. The contract was afterward brought to them to be signed, but instead of the specifications presented to them in the first instance, the contract included a revised set of specifications which increased the expense of the proposed work $1,000. The firm refused to sign the altered specifications, and the contract as modified was taken by another builder. Mr. Olmsted sued to recover the $1,000 difference between the two bids, but the jury found the facts to be as stated by defendants. A counter-suit is probable from present appearances.—*Hartford Times.*

BOOKS & PAPERS

THERE is a great deal that is interesting about the Italian art of the period immediately preceding that of Raphael; indeed, in some respects, one is more completely fascinated by the simple-minded, sincere attempts of the pre-Raphaelite artists than by any of the later work. That the earlier artists are not more generally appreciated by those who view art from the outside, as it were, is not difficult to understand. Art in those days was the right hand of religion. Themes were selected and topics were treated in a manner totally at variance with the easy, offhand, realistic mannerisms of our modern painters, just as the life and training of a painter in A. D. 1500 were radically different from what they are now; and the busy merchant or professional man of the present generation cannot be expected to appreciate the work of a Florentine monk, like Fra Angelico, for instance, who beheld everything with the eyes of faith. In composition the old masters often seem stiff and unnatural; the coloring is crude and uncertain, and the conception of the subject almost ludicrous in its earnestness. But take the point of view which the old painters had; see things as they saw them, imagine all the silent influences of long generations of men who revered their art and were almost ready to worship the works of their own hands, as manifestations of the divine spirit brooding over humanity, and then see if, after all, our ideas would not naturally lead us to just such compositions and just such naïve renditions as characterize the pre-Raphaelite artists. They were true children of nature, and they composed as they thought — crudely, unevenly, wrongly perhaps; but naturally, just as a child draws its pictures on a slate, and imagines them beautiful, because they represent beauty to him.

Fra Bartolommeo[1] may properly be termed the last of the pre-Raphaelites, for though he was a contemporary of Raphael and Michael Angelo, and showed many of the characteristics which marked the highest development of the Renaissance, he had also the sentiment of the earlier days — the feeling for quiet simplicity and breadth of conception, and the strongly-marked religious enthusiasm, such as was quite lacking in the works, as well as in the lives of the later and more developed artists. Bartolommeo, or Baccio della Porta, was born at Florence in 1475. His parents were poor, and of very humble origin, but his rise in art appears to have been none the less rapid, for, when only nine years of age, he was placed in the studio of Cosimo Rosselli, upon the recommendation of the celebrated sculptor, Benedetto da Majano, and after an apprenticeship of only six years, an unusually short time for those days, opened an independent studio in company with his friend Mariotto Albertinelli. At this time, Savonarola was moving all Florence with his wonderful preaching. Bartolommeo became a warm adherent to the new views, and a strong personal friendship arose between the great reformer and the young artist. A few years later, when the tide turned, and San Marco was besieged by a mob seeking the life of Savonarola, della Porta was at his friend's side, but so horrified at the deeds of violence going on about him, that he vowed to enter the order of St. Dominic, if he escaped from the threatened danger. He was unmolested, and two lears later fulfilled his vow by entering the convent of San Marco, at Florence. This was in 1500. Fra Bartolommeo was already a painter of considerable reputation, and his monastic associations were in no wise such as would check his career. Fra Angelico had been an inmate of the same convent years before, and the sunny cloisters of San Marco had always fostered art in all its branches; consequently it is not surprising that Fra Bartolommeo's best and most natural development came after he had assumed the holy orders.

About 1506 a friendship arose between Fra Bartolommeo and Raphael, who was then comparatively little known, and the two artists exercised a strong influence on each other. From Fra Bartolommeo Raphael learned how to more properly mix his colors, how to give them more brilliancy of tone, to combine them so as to obtain more seductive effects in the half-shadows, to treat the draperies with more breadth, and to give a nobler style to his figures; while on the other hand, Fra Bartolommeo was made to feel the effect of the exquisite taste and the divine fire of inspiration which illumined every work of the younger genius. Many of Fra Bartolommeo's paintings show how strongly his mind was influenced by Raphael. Two years later he came under another influence, even more powerful in its effect upon his art. It had been one of his ideals to unite with the exact drawings of Da Vinci and the grace of Raphael, the brilliant coloring of the Venetian masters; and in 1508 he made a long visit to Venice, returning with his artistic sense so penetrated with the rich Venetian effects produced by such masters as Giorgioni, Titian and Luciani, all of whom were alive at the time, that the influence is visible in all his subsequent work.

About this time Fra Bartolommeo and Albertinelli renewed their relations with each other, entering into an agreement to paint together, according to what Vasari says; Fra Bartolommeo furnishing the outline, and even roughing-in the masses of light and shade, while Albertinelli did all the rest of the work except the final touches. Such association was by no means uncommon in those days, one-sided as it may appear to us now, and it enabled the *Frate* to accomplish a great deal of work. The compact was not permanent, and the fact that the two artists worked together for a few years seems to be the only reason why M. Gruyer should associate them in his biography. Taken all together, they had really but little to do with each other, and Albertinelli occupies a very inconsiderable portion of the work under consideration.

In 1514 Fra Bartolommeo visited Rome, where his genius received a fresh inspiration from Michael Angelo, as well as from association with his old friend, Raphael. But though at times under so many different influences, Fra Bartolommeo was in some respects always the same, and not even the mighty talents of Michael Angelo could change his simple, quiet ways of thinking and composing, nor alter that sweet dignity which marked him as one of the long line of old masters who charmed by purity of sentiment rather than by excellence of execution.

Rome was fatal to Fra Bartolommeo, as it has been fatal to so many great artists. He was seized with a fever, and although a prompt departure saved his life for the time being, his health was entirely broken, and in 1517 he expired at Florence, being then only forty-two years of age.

In the history of art, Fra Bartolommeo never attained the highest position, though his talents entitled him to rank with the best. He occupies a middle place between the earlier artists, who thought more than they painted, and the later ones of the perfected Renaissance period, who were inclined, perhaps, to paint more than they thought. Never before had composition been so harmoniously worked out, or so profound a science in art been combined with a simplicity so seductive. Some of his unfinished paintings permit us to judge in a measure of his processes of working. The figures were first drawn nude, from living models. Then he disposed his draperies, making use of a manikin to aid him. The painting was prepared entirely with bistre, all the modelling, the exact lights and shades, and even the smallest details being worked out in the single pigment. And finally, he went over the whole with very thin tones of color, thus obtaining a transparency and sparkle such as was almost unknown before.

Influenced in turn by the chiaroscuro of Leonardo da Vinci, the incomparable grace of Raphael and the warm coloring of the Venetians, Fra Bartolommeo added to the style peculiar to himself something of the special qualities of these different painters, and, by combining the resources of a genius of the second order with the inspirations of a noble soul, he succeeded in conquering a place beside the great painters of his century. In general, he refrains from expressing strong emotions, preferring to dwell upon the sentiments of souls plunged in divine ecstasy. A serious, thoughtful grace shines upon his figures, which seem gilded as by a ray fallen from the sky of Venice.

Such is the summing up which M. Gruyer makes of the artistic character of Fra Bartolommeo. The biography is admirably written in all its details, and is made doubly valuable by the addition of twenty or more excellent engravings and a catalogue and description of all the existing paintings and drawings of the master.

[1] *Les Artistes Célèbres: Fra Bartolommeo della Porta et Mariotto Albertinelli*; par Gustave Gruyer. Paris: Librarie de l'Art, J. Rouam, Editeur.

COMMUNICATIONS

SHRINKAGE IN SOLID TIMBER WALLS.

HARTFORD, CONN., January 25, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In your issue of the 22d inst. you mention editorially Dr. Wight's construction of a hospital, in which the walls are of planks, one above the other, firmly spiked. Would not the shrinkage in such construction be serious? Where door-frames and other vertical features are introduced, would not some joints open?

Yours truly, H.

[THE shrinkage is likely to be somewhat troublesome, but door and window frames could easily be ploughed into the ends of the planks so as to allow some play without opening the joints. In the Swiss houses, which are built on the same principle, of superposed timbers, the effect of settlement due to shrinkage is avoided in various pretty ways.— EDS. AMERICAN ARCHITECT.]

DEMANDING A RETAINING FEE.

PHILADELPHIA, February 1, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you kindly give me your opinion on proper professional procedure in the following case: An architect submits preliminary sketches for a building in a distant city, his drawings are accepted and he is ordered to complete them with full specifications and details. Should his clients forward a retainer with their order, as in legal professional service, or would it be in bad taste for him to demand the same in event of their not sending it?

Yours truly, GENO.

[IT is regretable that it is not customary for clients to pay a retaining fee, as is commonly done in securing legal advice. It is customary, however, for an architect who understands anything about contracts to conduct the preliminary correspondence with his client in such a manner that the correspondence itself should form all the evidence that a court would require to establish the existence of a contract between the two. There might be no "impropriety" in suggesting the payment of a fee, though it would be rather unusual. — EDS. AMERICAN ARCHITECT.]

SCHOOLS OF FURNITURE DESIGNING.

BALTIMORE, February 7, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you please inform me, through your paper, what schools there are in Boston or New York which give special instruction in furniture designing.

An early answer will greatly oblige, Yours respectfully,
CHAS. J. KNIPP.

[WE do not know that there are such schools. — EDS. AMERICAN ARCHITECT.]

BOOKS USED AT THE MASS. INSTITUTE OF TECHNOLOGY.

MILWAUKEE, January 22, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I would like to know what books for study are used in the Boston Architectural School, from the lowest to the highest grade, and the price of same, and where I can get them. Please answer through your valuable paper, and oblige STUDENT.

[INSTRUCTION in the Architectural Department at the Massachusetts Institute of Technology is given almost wholly by lectures and by exercises upon the subject-matter of the lectures. — EDS. AMERICAN ARCHITECT.]

A CASE OF DISPUTED COMMISSION.

ALBANY, N. Y., January 25, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I have commenced a suit for services rendered a client, who, after causing full professional services — superintendence excepted — finally decided not to build.

I wish to place in the hands of my lawyers the various reports of legal cases bearing on the above.

Can you assist me in this matter? Perhaps a request in your journal will result in the forwarding to *you* — as I do not wish my name published — of reports, etc. Very truly yours, SYPHAX.

[WE should be glad to have our readers send us any information they can on the subject, to which we can add, perhaps, a few citations later. "Syphax" should not forget, however, that the case is one which the jury will have to decide. It would be foolish for his client to claim that he need not pay a fair price for services rendered at his request; and, judging from the analogy of similar cases, the defence will probably be that the architect was not employed by the other party, but volunteered his services; or that he agreed that he should not be paid for his work unless the plans were carried out; or that the services were not such as the client desired, and were valueless to him. Of the validity of all these claims the jury will have to judge, and will decide also upon the compensation which the architect is entitled to receive for his work if the client fails to establish his right to obtain it for nothing. The evidence upon which its decision will be based differs for every case, but it may be comforting to remember that juries are not easily persuaded that architects have volunteered to do their costly and responsible work for nothing, or for the chance of getting paid if the building is carried out, but not otherwise. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

THE ECONOMY OF USING FUEL-GAS. — A series of tests has recently been made by Dr. Fischer, the well-known German chemist, showing that in ordinary domestic stoves in use not more than 20 per cent of fuel consumed is really utilized for warming the rooms, whereas, with stoves burning gas 80 per cent and more of the possible effect is obtained. In a sugar manufactory at Elsdorf, it is stated, no steam-engines have been used for several years. Gas is made at a cost of about 10*d*. per 1,000 cubic feet, and is used for lighting and driving gas-engines. At the Essen works water-gas is made at a cost of 4*d*. to 8*d*. per 1,000 feet, and serves both for fire and lighting. — *Exchange.*

MONOLITHIC REMAINS IN INDIA. — Many theories have been advanced as to the manner in which Stonehenge was erected, and it has even been conjectured that it must be a Roman building because of the impossibility of rude tribes erecting such huge stones. The following note on the Nagá Hill people, one of the hill-tribes of India, will perhaps throw considerable light on this subject. It occurs in the *Journal of the Asiatic Society of Bengal* (vol. xliv., pp. 319, 320), and is as follows: "Huge monoliths exist here. These stones, which are often very large, and have sometimes to be brought from long distances, are dragged up in a kind of sledge, formed out of a forked tree, on which the stone is lowered and then carefully lashed with canes and creepers, and to this the men, sometimes to the number of several hundreds, attach themselves in a long line, and by means of putting rollers underneath, they pull it along until it has been brought up to the spot where it has been decided to erect it. Here a small hole is then dug to receive the lower end of the stone, and the sledge being tilted up on end the lashings are cut adrift, and the stone slides into position. Some leaves are then placed on the top and some liquor poured over it. This done, a general feast follows, and the ceremony is complete." — *Antiquarian News.*

TRADE SURVEYS

THOUGH not strictly within the province of a trade survey, the contemplated appropriation of $21,000,000 for coast defences, which ultimately will involve no less than $100,000,000 according to high engineering authority, should not be passed over in silence. It would be an easy matter just now for a foreign fleet to give a stimulus to building operations in any or all of our Atlantic coast cities by destroying them, as they easily could in a few hours. Very eminent and conservative writers and thinkers have, from time to time, called the attention of the active political managers to the possibilities of such disasters, but have received evasive replies year after year. Meanwhile, public opinion has been arousing itself to the possible dangers of such a result, and there now exists a more or less favorable sentiment in favor of the appropriation of enough of the public money to inaugurate necessary defences for some of our leading Atlantic coast cities. The country is collecting more revenue than it is in need of, and, while this is the case, it might be well to put the hundreds of millions of real estate along our sea-coast in a defensible position. European governments are bending all their energies to warlike purposes, and while the possibilities of an invasion from abroad are extremely remote they still exist. The science of warfare has advanced very rapidly during the past twenty years, and a comparatively small percentage of the well-informed citizens are familiar with what a hostile fleet can do along our coast. It would be a very easy matter for a hostile power to collect an indemnity from us. Our law-makers and those in control are beginning to recognize the nature and extent of the possible dangers involved in our comparatively defenceless coast. Speculators on both sides of the Atlantic are watching with the deepest interest the changing aspect of the European checker-board, to arrive at a result as soon as it is possible concerning a foreign war. American stock-speculations are held in check in the presence of this danger. Speculators are making preliminary preparations for enormous purchases of provisions and material for use abroad. No outlays have as yet been made, but a great deal of careful figuring has been going on in New York and Chicago, and, should a conflict break out, it will find the American speculators up and ready to turn an honest penny. The industrial situation throughout the interior remains just about as it has been for several weeks. Bank clearings show a decided increase in exchanges over last year and the preceding year; and the best commercial authorities unite in saying that there will be an increased percentage in domestic exchanges during the coming two months as against the same two months last year. The fear of higher prices and the possibility of an unexpected demand in the various channels of trade, coupled with the possibility of a foreign war, and the unknown contingencies which are always likely to arise, have led the great majority of manufacturers and railroad-builders and business men in all avenues to provide quite liberally for the requirements of the coming three or six months. This policy has about reached its highest point and the markets from Boston to St. Louis show a quiet tone, the result of a feeling that sufficient preparation has been made to guard all interests concerned against any sudden fluctuations in values. Manufacturers are liberally supplied with material at prices considerably below those now prevailing. The smaller buyers who are now in the market find themselves obliged to cover at the advance; but even this activity will be of short duration. Architects have more good news to furnish. In New York, Philadelphia and Baltimore, warehouse capacity is to be added to facilitate railroad-freight and ship-freight movements. In several cities office-buildings are contemplated, and architects are now engaged on preliminary drawings. Small-house building will occupy a great deal of attention this year. The larger cities will witness an outflow this year and next, which will increase until conditions equalize themselves in the way of cost and comfort. Fewer apartment-houses will be built in New York, and more small individual homes will be built on the outskirts. So at Philadelphia. No less than a dozen new towns are building up or projected there, composed, or to be composed, mainly of the overflow from the city proper. The same efflux is observable at Cincinnati, Chicago, and St. Louis. Real estate is in good demand wherever manufactures exist. Workmen's houses will be built on a large scale all over the West. The Building and Loan Associations are helping in this. Money-lending associations are extending their operations, and individuals are also putting money into houses, lots, shops and factories.

The present healthy real-estate activity is the result of causes which have been at work since 1883, and the fresh impulse given to the industries in general, and to railroad-building in particular, will continue to reflect itself in higher real-estate values in cities, and in improving demand for real estate in small towns and along the lines of railroads in all sections of the country. There is a heavy outflow of population seeking better conditions, and it finds lodgment along the lines of roads Northwest, West and South. Western builders speak of this tendency as laying the foundation for a broader industrial activity during the next few years. Railroad-builders have been encouraged to renewed enterprises, and at this time contracts are in hand for the laying of about 25,000 miles of track for which money has been subscribed, and contracts wholly or partially entered into. This year's output of rail-mills may reach 2,000,000 tons. At least, the capacity is equal to that production; and to all appearances the demand will size up to it. The latest reports from the larger locomotive-works show that the summer demand is coming in freely, and that by the 1st of April nearly all of the locomotive-building establishments will be sold up for six months. The car-works are about as well sold up, and also the car-wheel works, car-axle works, and the founderies and machine-shops which supply railway equipments. All of the larger electrical-supply companies are also largely oversold, and an extension of capacity is contemplated by several of the best-known companies in the New England and Middle States. The coal-interests have not yet determined upon a policy for the coming year, and just at this time they are disinclined to make public any programme that they may have in mind, owing to the fact that the lawmakers are giving these combinations more than usual attention with a view of restricting their illegal combinations if they exist. The bituminous-coal interests along the Atlantic coast have finally agreed upon production and prices, and an extensive development of new coal-fields in this region has been determined upon by those interested in railroad-building. The textile-manufacturing interests are gaining in orders every week. In most departments prices have advanced very little as against the selling-prices of last season, and competition will very probably prevent much of an advance in any direction. The agricultural-implement works throughout the West, the wagon-works, carriage-establishments, and the tool-works everywhere, are now, and for a month past have been, booking a good many orders for spring and summer delivery; many of the orders being for stock to be carried under the possibility of a sudden demand during the coming six or eight months. There is an abundance of money offered to prosecute all legitimate industrial and manufacturing enterprises, as well as for a goodly number of engineering and railroad-building schemes. Every week develops some new railroad-building enterprise of vast proportions. The objective point of this railroad-building is to improve the value of land; and it generally happens that the promoters of the new railroad-building schemes are largely interested in the land which will be developed by the construction of the road. Comparatively few important failures have been announced within the past two or three weeks, although numerically the number is nearly equal to that of the corresponding weeks last year. The general volume of business is increasing steadily week by week. Collections are fair. Credits are carefully guarded, and the commercial interests are being protected with more than ordinary watchfulness.

The American Architect and Building News.

Vol. XXI. Copyright, 1887, Ticknor & Company, Boston, Mass. No. 582.

FEBRUARY 19, 1887.

Entered at the Post-Office at Boston as second-class matter.

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THE question whether an architect's contract with his client is of such a kind that he is entitled, if dismissed without good cause before his work is complete, to claim the full benefit which he would have derived from carrying it out to the end, has recently been decided both here and in England, with the same result in each case. In the English case the defendant was no less a person than the Earl of Shrewsbury and Talbot, This august personage employed Mr. Birch, an architect of reputation, to take charge of the work of restoring his lordship's splendid old mansion of Ingestre Hall, which, as our readers will remember, was nearly destroyed by fire a year or two ago. Certain alterations were to be made in the building, and new stables added, and the architect made an agreement with Lord Shrewsbury, by which he undertook to do certain portions of the work without charge. When the buildings were nearly completed, Mr. Birch was summarily dismissed, without any reason being given him; and after waiting in vain for explanation or apology, he proceeded to make out and deliver a bill for full professional service, including a charge, on the usual scale, for the work which he had agreed to do for nothing. On appearing in court, Mr. Birch claimed, with good reason, that although he had agreed at first to make no charge for these portions of his service, the circumstances were now altered by the conduct of his employer, and he was fairly entitled to demand and receive remuneration for this, as well as for the other parts of his work; and that under his contract he was entitled also to charge the usual and reasonable fees for his services on the work actually carried out under his supervision, as well as two and one-half per cent, or one-half the full fee, on the cost of work done without his supervision, and subsequently to his dismissal; this being, we suppose, his estimate of the profit which would remain to him after deducting the expense which he would have to incur in completing his service. The defendant, of course, claimed that Mr. Birch should be held to his agreement not to charge the full price for his services, and that he was entitled to nothing for the work which he did not do; and certain sanitary engineers and furniture dealers and decorators were called in to testify that they had prepared designs and done work about the building, independent of Mr. Birch's supervision. Two distinguished architects, Mr. Charles Barry and Mr. William Young, were called for the plaintiff, to testify to the fairness of his charges and the custom of the profession, and the defendant's counsel thought it prudent, after the first witnesses had been called on each side, to abandon his case, and agreed, if the action were withdrawn, to settle the bill to the satisfaction of the plaintiff, and to pay all the costs.

THIS is not the only country, as it seems, where builders and architects occasionally forget the precautions which the difficult art of construction imposes upon those who presume to exercise it. A few weeks ago, as we learn from a thoughtful and intelligent account in the *Bautechnische Zeitschrift*, of Berlin, a four-story building, in process of erection in Cologne, fell suddenly, just before its completion, burying in its ruins seven men, four of whom were killed outright, while the others were severely injured. So serious an accident would in any country, excite a good deal of attention in the profession and the *Zeitschrift*, after collecting as carefully as possible all the information available in regard to the building, proceeds to analyze it, in search of the cause of the catastrophe, with true German patience and precision of scientific knowledge. The walls of the wrecked structure were of brick, twelve inches thick, enclosing a rectangle twenty-two by forty-two feet, and were laid up in four or five weeks. It is rather amusing to us, with our traditions of three or four story brick houses built complete and ready for occupancy in four weeks from the time of commencing the excavation, to find this unprecedented and dangerous haste severely condemned by the expert writer of the article; but it must be acknowledged that he clearly proves his theory that, although the building would have fallen, even if the masonry had been carried on more deliberately, its fall was hastened by the soft, or, as we say, the "green" condition of the walls when the floors were laid. These floors, after the German manner, were supported by three iron I-beams, forming girders upon which were laid the joists. The usual fire-proof filling had been put between the joists, and the floor-boards were lying piled in each story, ready for nailing down. Knowing the usual weight of the flooring and fire-proofing, it was easy to calculate the load on each beam. The evidence seemed to show that the beams did not fail, but it was proved that they were laid directly into the walls, without the bond-stones or iron plates, which are always used with us under the ends of iron beams; and, knowing the width of flange of I-beams of the requisite depth, and assuming that they had a bearing of eight inches in the wall at each end, it was readily shown that half the load on each beam, which amounted in all to about twelve tons, was sustained by an area of brickwork measuring eight inches by four. We usually reckon the maximum safe load on brickwork at about two hundred pounds to the square inch, so that the actual strain in this case would have been about twice as much as is considered prudent in Philadelphia, or New York, or Boston; but the German brickwork is inferior to ours in the quality of the mortar ordinarily used, and the actual pressure under the end of the beam was about three times the maximum prudent strain. Under these circumstances it is not surprising that the masonry, particularly in its soft condition, gave way, and the building fell, for want of a little attention to a simple point.

THE great Exposition of 1889 continues to occupy a large space in the pages of our French exchanges, particularly in those of *Le Génie Civil*, which has just been made the official organ of communication between the directors of the exhibition and the public. At the last accounts it seems that all the details of arrangement, together with those for public convenience and comfort, will be studied with a care hitherto unknown in connection with such affairs. One of the best suggestions we have seen is that made by the ever-practical and ingenious M. Eiffel, who proposes, as a substitute for the wheeled chairs, by means of which tired and feeble persons enjoy such shows to the detriment of the comfort and patience of other people, to construct an electric railway about the buildings, over which cars, suspended from the rails just far enough from the floor to clear the heads of persons passing beneath, may run in all directions, giving an unrivalled view of the contents of the exhibition, both in mass and detail, and enabling passengers to stop when and where they like, and to pass rapidly from any part of the buildings to any other, without encroaching on the floor space, or interfering in any way with the crowd of sight-seers on the floor. Those who remember the interminable wanderings, the aching limbs, the perplexities and disappointments, which attended the effort to see the Philadelphia exhibition, will appreciate the opportunity which such a scheme as this of M. Eiffel's, if carried into execution, will give for enabling visitors, not only to reach particular points quickly,

but to take at their ease a rapid general survey of the whole exhibition, before making their choice of the departments to which they wish to give close attention.

THE project for constructing a tower a thousand feet high, in Paris, to commemorate the French Revolution, seems to have excited, as the *Revue Industrielle* says, other nations to emulate the example of the French in gigantic works of engineering. The English, having a good excuse in the occurrence of the fiftieth anniversary of the Queen's accession, have already made contracts for the erection, in London, of an iron tower four hundred and forty feet high, which is to be situated at the highest point of Oxford Street, and will, at times when there is no fog, as the *Revue* sarcastically observes, command a view over eight or nine counties. It is a pity that this structure should not have been as lofty as the Paris tower. An observatory a thousand feet high would, we should imagine, reach in still weather beyond the upper limit of the smoke stratum which envelopes the city; and there would be something novel as well as instructive, in looking out over the upper surface of the impenetrable blanket of smoke which hid the town, to the green hills beyond. In Belgium, it is proposed to construct, in a position which we do not find specified, an enormous bridge of some sort. As Belgium possesses no large river, except a small piece of the Scheldt, it is not easy to see where such a bridge could be put, unless, indeed, it is intended to span the country entirely, as a military device to enable France and Germany to get at each other without violating the neutral soil below.

A CURIOUS light is thrown upon the formation of the region of which Russia has lately taken possession in Asia, by the experiments made by M. Nicolsky, a Russian traveller, who has studied the lakes which dot the surface of the country. One of the largest of these is Lake Balkash, which lies near the Chinese frontier, not far from the important city of Kuldja. The lake is one hundred and fifty miles long, and seventy-five miles wide, being thus a little longer than Lake Ontario, and receives the Ili, a river about three hundred miles long, besides several smaller streams; yet, although it has no outlet, and is constantly supplied by these streams with fresh water from the neighboring mountains, the effect of evaporation, even in a latitude considerably farther north than that of Montreal, is so enormous that the level of the surface of the water in the lake steadily falls, at the rate of nearly three inches a year. The *Revue Industrielle*, taking into consideration the area of the lake, reckons that the amount of water thus totally lost every year, which, it must be remembered, is only the remainder left after subtracting from the quantity evaporated that restored by the rivers, would cover the whole of Paris, within the fortifications, fifty-six feet deep. As Lake Balkash is estimated to occupy only one-seventeenth of the total area of the salt lakes of Asiatic Russia, all of which, so far as known, are undergoing a similar diminution in volume, it may be conceived how serious is the loss which the barren country of Turkestan is now suffering. Whether the energy and science of Russia will ever be able to arrest the encroachment of the desert, and restore its Asiatic provinces to fertility, remains to be seen. It is said that since the settlement of the Mormons about our own Great Salt Lake, which, in situation and character, strikingly resembles the salt lakes of Asia, the volume of water has increased, whether by reason of the increased rainfall due to the cultivation of its banks, or for some other reason, we will not venture to inquire, so much that certain houses, built thirty or forty years ago upon its banks, have had to be moved to keep the water from invading them. We do not know how much truth there may be in this story, but if Russian colonies, by care and patience, could transform the lake region of Eastern Turkestan into anything like the unrivalled agricultural country which surrounds our Salt Lake, the Empire would have nothing within its borders in which it would take more pride.

ACCORDING to *La Semaine des Constructeurs*, the mosaics in the Church of Saint Sophia, at Constantinople, are rapidly perishing, and unless something is done at once to preserve them from the attacks of dampness and barbarism, they will soon disappear, even if the church itself should not fall in with them, which seems now not improbable. We all remember the letter of some traveller to one of the New York journals, complaining that the galleries of the building swarmed with boys, carrying long poles, with which they punched off fragments of mosaic from the domes and arches, to sell to the tourists who visited the building; but it seems that the elements have now taken part in the work of destruction, and instead of small pieces, the rain, pouring into the seams of the neglected roof, and soaking through the light, spongy bricks of the domes, throws off great patches of the mosaic, which no one takes the trouble to replace. In fact, the Sultan, the theoretical owner of the building, is said not to have been in it since his accession, and no one else in Turkey has either money or taste enough to take any trouble about the matter. Even if the mosaics should be restored, it is said that the enormous buttresses, which were built forty years ago by the Italian architect Tossati, to resist the dangerous spreading of the domes, have proved to be wrongly applied, so that the movement, although checked for a time, has recommenced; and, as Tossati's buttresses stand in the way of building any others, it is quite likely that our children may see the greatest and most precious example of the later Greek architecture, as well as the only worthy relic now existing of Imperial and Christian Rome, fall quietly into a heap of ruins.

A RATHER large claim is made, according to the *Builder*, for a new method of gas-lighting, introduced by Dr. Arier, of Vienna. Most people know something of the way in which magnesia cylinders are now used by placing them in a stream of gas, to give out by incandescence a light far more brilliant than that produced by the same amount of gas burning with a flame. In brief, the effect is produced by lighting the gas-jet, directing it upon a sort of skeleton of magnesia, made by saturating cloth with a solution of magnesia salt, and then burning out the organic matter, and, after the magnesia has become hot, putting out the flame, and turning the gas on again without lighting it. The gas then burns without flame in the pores of the magnesia, raising it to intense whiteness, and producing a light which can be compared with that of the electric arc. Dr. Arier's new lamp is in principle the same as this, but instead of a delicate magnesia skeleton, he uses a cylinder with perforated sides, the composition of which is kept secret. Two cylinders are used, one above another, the gas passing through the lower, and striking against the upper one, which emits a dazzling white light. The cylinders last a year or more, under ordinary use, before they need to be replaced by others, and each is said to produce a light of about twenty-four candle power, with a consumption of a foot and a half or two feet of gas, while the ordinary burners give a light of only twelve or fifteen candles, with the consumption of five or six feet of gas an hour. Moreover, the incandescent lamps burn hydrogen, which costs only a fourth as much as coal gas, with excellent results, while hydrogen in an ordinary burner would give only the faintest possible light.

BECAUSE of sundry alterations at the printing-office, which have made it a very inconvenient work-room for the printers, more than the ordinary allowance of typographical and other blunders have crept into recent issues. Particularly was this the case a fortnight ago, when, instead of using the sufficiently unfamiliar word "menhir," the reader was bewildered by finding that the compositor had set it "menlier." Perhaps as amusing a mishap as ever was occasioned by a printer befell the word "*vivantes*," which came to us on the proof set as "*montes*," and we, without referring to the copy, quite naturally corrected to read "*mortes*," and so shared in bringing about a complete reversal of the meaning of the word actually written.

WE hope that many of our readers will take some convenient opportunity to see the "Old London Street," which has been brought from London to New York, and is to be erected near Broadway. Although made in part of concrete and other artificial materials, there is nothing resembling theatrical scenery about the structure, which, since it was built at South Kensington, about three years ago, as one of the attractions of the series of exhibitions which have been held there, has excited constant interest and admiration. The original cost of the double row of picturesque houses, of which it consists, as erected at South Kensington, was about eighty thousand dollars. It was sold, when the ground occupied by the exhibition buildings was cleared, for eight hundred; but, considering the labor required for numbering the pieces, taking-down, packing, shipping to New York and rebuilding, this was perhaps the full value.

AMERICAN INSTITUTE OF ARCHITECTS.[1] — II.

AUTHORIZED REPORT, CONDENSED.



Second Day, Morning: — After presenting and reading the report of the Chicago Chapter [*ante*], Mr. Bloor read a report of his visit, as delegate of the Institute, to the Second Annual Convention of the Western Association of Architects, held in St. Louis, November 18 and 19 of the previous year. He referred to the cordial welcome he had received as the Institute's representative; described the Convention's course whenever the Institute was involved; gave in detail his action as a member of the Institute committee for introducing changes in the methods of producing Government architectural work, with the corresponding committee of the Association; mentioned that he had pointed out to the retiring and incoming Presidents of the Association that it was going through the same experience as that familiar to the Institute — that already he perceived in its membership an incipient faction beginning to stigmatize its processes as "old fogy" and provincial, and that harmonious action with the Institution on all important points was a desideratum it could not afford to overlook. The report concluded with the following observations:

"The impression made upon me during the performance of the mission you entrusted to me is that the Association, equally with the Institute, has the good of our art and of its professors at heart, and that it is our duty to work cordially with it. The more closely we are united, the speedier will be the realization of our common objects. Those who are not with us are against us, and we have worked too long and too hard to see complacently the fruit of what we have sown scattered abroad. The architectural productions of the West include many examples quite equal to any buildings erected for similar purpose on the Atlantic sea-board, and the Western Association comprises in its membership men of professional acquirements which give them a just claim to equal standing with members of architectural bodies anywhere in the world. The training of many — perhaps of most of them — has been received in the East, and of some of them in Europe, and there is, therefore, no inherent difficulty in the way of the assimilation, for all practical associative purposes, outside of merely local details, of the two bodies. There will very likely be shown at first, among the most active of the new association, an inclination to the undervaluation of the Institute and to the over-assertion of their own existence and methods; but this will soon wear off as they discover for themselves the difficulties with which we are so familiar, and before long we shall doubtless find the value of new blood in pursuing and gaining the objects which must necessarily be common to both organizations."

Mr. Bell referred to the bill now before Congress, prepared by the Institute and the Western Association, for the better ordering of the architectural service of the Federal Government, and expressed the opinion that there were objectionable features in it which would prevent it from becoming a law.

Mr. Bloor said that the Committee on the bill was familiar with the objections to it as well as with those against the changes proposed by Mr. Bell. He hoped Mr. Bell would exchange views on it with the committee, either informally or through appointment.

Mr. Bell said he should be pleased to work with the Committee, and would do so officially, as part of it, if thought best; though he thought, as an office-holder under Government, he could better act with it informally.

Mr. Kendall moved, and it was carried unanimously, that the Institute Committee on the bill be continued, and that the Western Association of Architects be requested to continue its joint committee.

Mr. Root, as President of the Western Association, promised similar action on the part of that organization.

Mr. Moser read an untitled paper, with the opening motto, "Hear me for my cause," advocating greater independence of ancient and foreign elements of design on the part of American architects. [See the *American Architect* for January 8, 1887.]

Mr. Chas. F. Wingate, sanitary engineer, was introduced by Mr. Bloor, and spoke at considerable length. He thought dryness of soil in the site of a structure more important than the quality of the plumbing, and that the damp-proofing of houses was an essential too often overlooked by those engaged in building. Ninety per cent of the cellars in New York city are stated on authority to be damp. The phenomenally low death-rate of London he attributed to the soil level having been lowered thirty-two feet to suit its magnificent system of sewers.

Referring to ventilation, he drew attention to the fact that expensive skylights are constructed on the roofs of houses, with stained-glass sashes underneath, hermetically closed, instead of being lifted up with open sides for ventilation. To meet the popular dread of a draught, and avoid especially the down-draught from skylights, he recommended the use of the Wing ventilator; and called attention to an electro-motor which has just come into use, and which, at the cost of a mere fraction as compared with former motors of the same power, may be used, within a space no larger than would be occupied by a small clock, to run a ventilating-fan for purifying the air in close rooms or closets. He criticized the deficiency of provisions for supplying light and sunshine in dwellings, and thought women architects were needed to plan houses, especially with reference to arrangements for closets.

Referring to plumbing, he laid great stress on the importance of having all soil-pipes enlarged to prevent their freezing. He also thought that air-inlet pipes are generally too small, and was strongly in favor of thoroughly tapping sewers and cesspools. To connect the waste of houses with the outside sewer, he preferred iron pipes, as called for by New York law, to the earthen pipe customary elsewhere. He had never found a single case of an earthen drain being properly laid. In country places, the spiral leader pipe, if well covered with asphalt, might serve for country houses with cesspools. He did not think the sub-surface irrigation system well adapted for ordinary use, and said something should be done in the way of quickly utilizing the contents of cesspools. He thought that the sanitary question should be pushed vigorously; that no American city needed more improvement in this line than New York, and that no class of men could do more to call attention to it than the architects.

Reports from the following Special Committees were read and accepted. To wit:

"The Committee appointed to examine and report upon the various Reports of the Officers of the Institute and of the Chapters, beg leave respectfully to state that they have examined the papers submitted to them, and would call the attention of the Institute to the following points:

First. They would recommend that the Committee on the Improvement of Federal Architectures be continued.

Second. That the Trustees be desired to embody in their next annual report some definite suggestions as to the collection of additional funds for the uses of the Institute.

The question of professional practice and etiquette having been referred to a special committee, your committee does not deem it necessary to offer any suggestions on this very important subject.

In reviewing the reports of the Chapters they would call your attention to the social meetings reported by two of the Chapters which, in the opinion of the committee, would have a good effect if followed by others.

Your committee is also of the opinion that the suggestion contained in the Treasurer's Report, that a class of "registered subscribers," consisting of persons interested in the various trades and manufactures more or less connected with building operations, should be established, would not be likely, if carried into effect, to promote the best interests of the Institute; as it seems to your committee that neither an individual nor an association of architects can safely receive contributions from persons more or less connected with building.

Very respectfully submitted by your obedient servants,

JAMES RENWICK,
JAMES G. CUTLER, } *Committee.*
GEO. A. FREDERICK,

Mr. Alfred Stone, from the Auditing Committee, reported that the Treasurer's report had been compared with the vouchers and found correct.

Mr. R. M. Hunt, from the Committee on Nominations, presented its report, and, in allusion to a letter which Mr. Bloor had written, prior to the Convention, to the prospective Committee, positively refusing to allow himself again to be placed in nomination as Secretary, except on conditions involving the substantial recognition of services rendered, during many years, at great sacrifice of personal interests and prospects, added: "We have had some difficulty in securing the Secretary. The duties of the Secretary are very arduous, and Mr. Bloor, who has served for some twenty years, was disinclined to accept the office again without compensation, to which he is certainly entitled, and which he should receive. But Mr. Bloor has kindly come to the front again; because it is a matter of impossibility to do the business of the Institute outside of the city of New York."

Mr. Frederick, Committee on Mr. T. M. Clark's paper on "Architects' Protective Associations," based on one existing in France, read its articles *seriatim*, with verbal comments. He said that M. Achille Hermant's introduction of the subject in the shape of a motion, that a committee be appointed to prepare a scheme for the establishment

[1] Twentieth Annual Convention of the American Institute of Architects, held in New York, on Wednesday and Thursday; 1st and 2d December, 1886. Continued from page 78, No. 581.

of a fund for mutual defence among architects in matters affecting their interests, meant, in other words, the establishment of an associated fund for the prosecution of justice for architects, in case their rights should be violated. As — unlike France, with the same laws governing every province — the United States has many varying State laws, and much diversity in court practice, he thought that the union of all architectural associations within the Union, would be necessary for the success of a League with such an object. Mr. Frederick ended with these words:

"The concluding remarks of Mr. Clark are thoroughly to the point, and it must be manifest to every member of our profession that such an adjunct and League, as herein suggested, could not fail to be of service to us, and possibly prevent many abuses which, I am charitable enough to believe, occur more frequently from a want of knowledge, than from design. I deeply regret the absence of Mr. Clark, to whom the delicate duty imposed upon me would naturally and properly have belonged, and who, with the thought and labor previously given (and I am sure continued), would have been able to give you a better digest, and more useful suggestions towards the matter, than I have been capable of doing. The labor he performed in preparing the paper presented abundantly proves his interest in the profession and cause and entitles him to our gratitude."

Mr. Root said he thought he could promise the very hearty coöperation of the Western Association of Architects in carrying out such a scheme as that suggested.

Mr. Hazlehurst thought the term "protection" implies weakness. No amount of law and no society, protective or otherwise, would make the public respect two men alike, simply because they belong to the same fraternity, if those two men did not show their own strength by their union.

Mr. Kendall said it occurred to him also, that when architects had learned to protect themselves against themselves, they would have less cause to protect themselves against their clients.

Mr. Upjohn suggested that a litigant should give bonds to protect the proposed Association from loss, in case of the failure of a suit carried on in his behalf.

Mr. Frederick explained that the assessments to be made by the Association were meant to meet such expenses.

Mr. Bloor moved that the matter be referred back to the original Committee of one, Mr. T. M. Clark, to report at the next Convention, and that Mr. Frederick be added to the Committee, and the W. A. A. be requested to add Mr. Root to it.

Mr. Kendall moved to amend that the W. A. A. be requested to add Mr. Smith, of Omaha, and that these four gentlemen select a fifth member of the Committee. The motion, so amended, was carried.

The following was read and accepted:

Mr. President and Gentlemen, — The Committee appointed to consider the charges of unprofessional conduct referred to in the paper read in your hearing at the session on Wednesday morning, respectfully offer the following report:

The documentary evidence in the case seems to be complete and conclusive. A member of the Institute has been guilty of offering his services in a case where another member was fully employed — at a rate of remuneration much below the schedule rate — and by this means not only secured the discharge from the work of the member first employed, but also, by testifying in court that the schedule rates are excessive, prevented the proper compensation of the member first employed for services rendered to the date of his dismissal. Your Committee finds that the Board of Trustees, at its meeting on March 5, 1886, passed a minute of implied censure, which seems to your Committee to be much too mild a penalty for an offense of so serious a nature against professional courtesy.

As the only action possible under the Constitution, we recommend that the Board of Trustees be directed to request the resignation of the offending member forthwith.

It seems evident that there is good reason for the appointment of a standing committee on the relation of members to each other, and we suggest that it should consist of five members.

Your Committee further recommends that the Constitution shall be so amended, at the earliest possible moment, as to enable the Board of Trustees to expell, instead of requesting the resignation of the offending member — in such cases — after giving the accused two weeks' notice of the date of the meeting at which such action is proposed to be taken.

Respectfully submitted,

C. A. WALLINGFORD,
JAS. G. CUTLER,
JOHN MOSER, } *Committee.*

Mr. Bloor referred to the recommendation made in the report just read for the appointment of a standing committee on the relations of members, and said that the Board of Trustees was already the standing committee on that point. He read Article I, Section 15, of the By-Laws to that effect.

Mr. Briggs thought that one man should not be singled out for a martyr, when, as he believed, there were other such cases within the Institute. He thought the administration of the Institute not sufficiently stringent as regards the admission of members.

Mr. Stone thought the fault lay with the voting members. They were derelict in not reporting to the Administration in regard to candidates against whom they could sustain objections.

Mr. Cutler thought the question before the Convention was not so much that of keeping people out, as of putting them out after they had got in.

Mr. Smith said that the question of the fitness of members was considered so important by the Western Association of Architects that it had under discussion the names of a number of its members who are supposed to be possibly unfit for continued membership.

The election of officers and standing committees being in order, the Chair appointed Messrs. Upjohn and Hazlehurst tellers, who, after the balloting was completed, announced that Mr. Hunt had received eight votes for President, but that a large majority of them were for the re-election of President Walter, and that the votes for the other nominees of the nominating committee were unanimous. The following ticket was therefore declared elected: —

President: Thomas U. Walter, LL. D., Philadelphia; *Secretary:* A. J. Bloor, New York; *Treasurer:* O. P. Hatfield, New York; *Board of Trustees:* H. M. Congdon, N. Le Brun, E. T. Littell, R. M. Upjohn; *Committee on Publications:* H. H. Holly, New York; T. M. Clark, Boston; Chas. Crapsey, Cincinnati; J. McArthur, Philadelphia. *Committee on Education:* Alfred Stone, Providence; Henry Van Brunt, Boston; Prof. N. Clifford Ricker, Champaign, Ill.; Prof. W. R. Ware, New York; T. M. Clark, Boston. *Secretary for Foreign Correspondence:* W. L. B. Jenney, Chicago.

Mr. Kendall moved that the election of the President be made unanimous, which motion was carried unanimously.

The Chair. — I return you my thanks, gentlemen, for your kindness and for your forgiveness. You might have done better all the time; but I began with you almost at the beginning, and have been in my place as often as it was possible, and have done the best I could; and I intended, when I came here, to decline a re-election; but my friends have been very kind and have asked me to agree to it if I were re-elected, and I have agreed to it for another year. After that, if I live that long, I will get you to allow me to take a rest. As to the year before us, I promise you to do all I can for the promotion of the prosperity of our profession, here and everywhere — for the promotion of the interest of our Institute. Everywhere and at all times I am yours, asking you now to look over my imperfections, and to enable me to feel still further that I have your sustenance in these matters connected with our profession. I am deeply interested in them, and have been for nearly sixty years. I shall not be troubled that way sixty years longer. Accept my thanks, I pray you. (Applause.)

Mr. Kendall, on behalf of the New York Chapter, promised Dr. Walter its hearty and loving support as long as he should remain President of the Institute.

The programme of the Convention included "The Labor Question" and "The Rights of Architects to efficient and reasonable Mail Service." The introduction of these topics was now in order, but there was a general feeling against carrying the proceedings over to the conditional third day, and both the afternoon and the evening were set apart for other engagements. These two questions were therefore referred to the Board of Trustees.

Mr. Bell moved that the President of the Institute appoint a committee of five to consider the project of providing a permanent home for the Institute, and said, "I was very much surprised, when I came to New York and assisted at this meeting, to find that there were no quarters in which the Institute could hold a meeting, except such as we have here in this building, owned by somebody else, or not permanently belonging to the Institute. It seems to me that if we are going to exist as an Institute, we ought to have some home to call our own, where we can assemble, and get our goods and chattels together, and see what we are as an Institute. I have no doubt at all in my own mind but what, if there is a committee formed of persons who are capable of taking this matter in hand, there is a way by which this Institute could have a home. It seems, too, that there ought to be brains enough in the American Institute of Architects to deal with the subject, and to get upon a basis where it would be of interest, both to capital and labor, to have a home for the Institute.

Mr. Hunt. — The American Institute of Architects is not a New York Institution. It belongs to the United States of North America; and any home that is to be provided in the city of New York will be for the New York Chapter of the American Institute of Architects. We do not want the annual meetings all held in New York; we want to have them in other cities of importance in the United States; we want the annual conventions held around in the different parts of the country.

The Chair. — It has been moved that a committee shall be appointed to consider the project of providing a permanent home for the Institute.

Mr. Bell. — Before that motion is put, I would like simply to say that I had no idea at all but that the American Institute was not an institution which belonged particularly to New York; but that we had a right to meet wherever we chose to meet, and yet I think that there should be some place that the American Institute of Architects could call a home; a place where they can have a library, and where, as an Institute, they can gather together the things which are necessary for them to have in order to keep pace with the Institutes in other countries as well as their own.

Mr. Hunt. — We started out with that idea, its projectors being in the city of New York, and there was a great deal of feeling about the country. The idea was that "New York wants to get everything," and we gave up the idea from that time, and we went to Chicago, Boston, Philadelphia, Washington and other cities, and every other city of the Union has quite as much influence as the city of New York.

Mr. Upjohn. — We were both members of the Institute and of the

New York Chapter at the time Mr. Hunt refers to. But it does not seem to me that it is the duty of the New York Chapter to decline any offer that is made to build a home for the Institute in the city of New York. Just as the General Government itself has a local habitation at Washington, although it concerns the entire country, so I think there should be some place which the members of the Institute could call a home. Now, if the people outside choose to come to New York, I, for my part, cannot see any objection, and they can rotate their further meetings wherever they please.

Mr. Briggs. — I think Mr. Bell's idea was in furtherance of Mr. Upjohn's remark — that this building he speaks of was not for the New York Chapter, but was for the whole Institute of Architects; that every Chapter in the country has an interest in the building located here. We do not object to go to other cities to hold the conventions. That we are very glad to do; that is the idea of the Institute. But for all that, the home of the Institute might be in this city, and then we should have a home.

Mr. Hatfield. — I think it is a proper motion that a committee should be appointed, to whom all these ideas we have proposed should be referred, and that they should report. I move that the committee consist of Mr. Bell and Mr. Littell. (Motion carried.)

Mr. Hunt called the attention of the meeting to the forthcoming Convention of the Architectural League of New York; and said that Mr. H. G. Marquand had been kind enough to say that he should be very glad to see members of the Institute, that afternoon, at his house, corner Madison Avenue and Sixtieth Street, of which he (Mr. Hunt) was the architect [except as regards the Japanese room, designed by Mr. Manly N. Cutter, architect].

After resolutions of thanks to the New York Mutual Life Insurance Company for the use of their directors' room, and to the New York Chapter for its hospitalities and kindness, past and to come (thanks to the retiring Secretary, Mr. Mason, being reserved for a later occasion), the Convention adjourned, subject to the call of the Board of Trustees.

Second Day, Afternoon.—In the afternoon Mr. Marquand and Mr. Hunt showed visitors over the former's residence.

Second Day, Evening.—In the evening the New York Chapter received their guests, the visiting members of the Institute, with the President, Mr. J. Beverly Robinson, and the Secretary, Mr. Chas. I. Berg, of the Architectural League of New York, at Pinard's, and at eight o'clock entertained them at dinner. Covers were laid for sixty, and about fifty-five gentlemen were at table. Mr. Kendall, President of the New York Chapter, presided, and opened the intellectual part of the occasion with the remark that he hoped all felt in the condition of Martin Luther, at the Diet of Worms, when he said, "Here I stand. God help me; I can take no other course." He spoke in warm terms of President Walter, and gave his health as the first toast, which was drunk standing, with great enthusiasm.

Mr. Renwick, being called on, thought the diet they had been doing justice to was very far from being one of worms. It gave him great pleasure to welcome to New York the Chapter's guests from the different cities of the Union, some of whom had come as far as from Paris to St. Petersburg, and it rejoiced him to think they took so much interest in the American Institute of Architects. He said they had all been looking out for an American style, and instanced one public building in New York, which, from the fact of its columns being all turned, might be called the "turn-stile," and another which from its inordinate cost of some seventeen millions of dollars, might be called the "Boodle" style. As the Secretary for Foreign Correspondence had such an appreciation of modern Greek that he actually brought an answer from Greece to one of his communications without knowing it, he (Mr. Renwick) proposed he should be accepted as the exponent of the Neo-Grec style in America.

Mr. Hunt, of New York, said he had recently been spending a year or more in Europe, and was delighted, wherever he went, at his reception as a member of the American Institute of Architects. Within two days after he arrived in London, the officers of the Royal Institute of British Architects called on him, and, during his short stay there, he dined with them several times and was shown every courtesy. In Paris, as a recently-elected Corresponding Member of the Institute of France, it became his duty to pay a formal visit to the home of the "Forty Immortals," of whom, having received his professional education in Paris, he had been brought up to stand in awe; and there, to his surprise, he had been received, *à la Français*, with kisses on both cheeks. And he was welcomed in the same way in Italy and Spain, and in all the other places he visited, simply by coupling his name with his membership in the American Institute of Architects. His observation taught him that architects in Europe take more interest in our Institute than we do ourselves, ten times over. But some of our honorary members and correspondents abroad had not heard from us in three years, and he hoped that in future our "*Proceedings*" would be sent to them without fail. [The administration of the Institute have not of late years been in funds to have a sufficient edition of its "*Proceedings*" for foreign as well as for domestic distribution.] The speaker proceeded with an account of his visits to different French architects and members of the Institute of France, among the latter the Duc d'Aumale, who took him over his splendid Château de Chantilly, renovated in modern Renaissance, on the foundations of an ancient feudal castle. [This historic pile, with its extensive modern appanages, the whole valued at over forty millions of francs — or eight millions of dollars — has, since the Duke's expulsion from France, as a member of the Orleans dynasty, been deeded by its owner as a free gift to the Institute of France.]

Mr. Wallingford, of St. Paul, Minn., agreed with Mr. Hunt that those at the East have no idea of how much esteem is felt for the American Institute of Architects and its members, by architects at some distance from its administration — how much influence it has among them, and how much it has nerved them to higher professional efforts.

Mr. John H. Sturgis, of Boston, declined to speak beyond saying that though he came from the Hub, he was not one of its spokes.

Mr. Root, of Chicago, President of the Western Association of Architects, thought it was a late stage of the dinner at which to speak to advantage of such a large and burdensome subject as the West. He spoke humorously of the hardships of those Ishmaelites of the profession who wandered out there some years ago. A friend of his, whom he had long known and wished he had liked better, had landed in Chicago just after its great fire, when everything was in a Phœnix-like state of development, and had been projected into the sudden hanging out of his shingle by a real-estate boom. He described a real-estate boom as the result of transactions beginning with A buying a hundred acres of farm-land for a dollar an acre, ten dollars down and ninety dollars on mortgage; and then, by certain appraising, "swapping" and mortgaging operations between himself and B, followed successively by similar transactions (all on paper, with no further cash outlay than the ten dollars paid by A) between B and C and between C and D, the property is put on the market for building purposes at a valuation of a hundred thousand dollars. At this stage another confederate real-estate operator, E, goes to an architect (generally an inexperienced one), and pointing to D as a millionaire, on the strength of the property to be built upon, magnified by this time to two thousand acres, sets him to work, with a multiplicity of prospective clients and limitless prospective commissions. The speaker remembered how this friend of his went into such business with an accumulation of commissions, the percentage on which would have amounted to say thirty thousand dollars; but who, the panic of 1873 occurring about that time, really came out of it with receipts of two hundred dollars and two suits of clothes. But things have changed wonderfully in Chicago since then, though architects still have their trials. For instance, a client visits New York, and, going back to Chicago, says to an architect: "I have seen *such* a lovely house on Fifth Avenue or Fifty-seventh Street; it is a poem. I want my house like that, but not so large; take six inches off the rooms each way. Please study your sketches thoroughly; take a long time to consider the thing carefully. I don't care to let out the contracts for quite a while — say three weeks from to-day." So the architect goes on with his sketches, and when it comes to the contract stage (having stolen all he dares from the New York man), suddenly finds that his client expects him to build the New York million-dollar house for fifteen thousand dollars! One can imagine the anomalies incident to this sort of thing, and how designs are realized in strange and wierd material. Gentlemen, you don't know galvanized iron! I have seen the front of a great arch, of at least forty feet span, symmetrically filled up with it, with a skill as consummate as was ever practised.

Mr. Alfred Stone, of Providence, said: "When Mr. Hunt spoke of the way in which he was received in Europe, and of the esteem in which the Institute of Architects is held abroad, much greater, he thought, than even that in which we ourselves hold it, I thought he hit the nail on the head, and I could not help feeling how much the the Institute needed the sympathy and the membership of its older and more successful practitioners to help it along and assist, in proportion to their opportunities in giving it tone; because I know it is looked up to in the smaller towns, both here and (as we have just had testimony) in the West, with a great deal of reverence; and it has done much to help the practice of architecture among those of us who have been in practice for twenty years or more. The great want is that it should have a vast increase of membership at the two ends of the line. One end is among our older and more successful practitioners. I am very sorry that they do not show a more active sympathy with the Institute, and that by lending their influence to it, they do not help to raise it above some of the charges which are sometimes made against members of the profession. And there is another large class whom we ought to have, and that is the younger members. I think we have not nearly so many as we should have of those who have graduated from the Massachusetts Institute of Technology, and who are coming out of the School of Mines in Columbia College, and from Cornell University and the College in Champaign, Illinois. Perhaps those who have come out of the latter, and newer schools, have not been in practice long enough to become members. But as I look back, and see those who have graduated from these institutions, and who are not enrolled upon our list of membership, it seems to me that one of the best works that our returned Secretary can do, is to be sure that when we have our next meeting our membership shall be double what it is now. If it were so, we should find no pecuniary troubles, and we should discover that, if we were judicious in the selection of members, we could soon frown down, and live down, the unprofessional practices which have been hinted at during this convention. There is a need of more *esprit de corps* among architects, which shall lift the profession to a plane higher even than that to which it has been raised. It is true that as I recall the state of things that existed when I first went into

an architect's office thirty-four years ago, and compare it with what it is to-day, I recognize that the tone of the profession is far above what it then was; but nevertheless, it is capable of being raised far more than it has been raised."

Professor Ware, of Columbia College, made lengthened remarks, very interesting, from the archæological, educational and associative points of view, as well as from that of one phase of architectural expression. He referred to the newly-established American School of Classical Studies at Athens, for which $25,000 have been raised in this country to provide a building. By its side stands the British School for identical purposes, and the two have already entered into relations of absolute comity and coöperation. The libraries of the two schools are to be substantially one; nothing in the one is to be duplicated in the other, and while they will be devoted mainly to literature, archæology and history, the American students are at the same time to have the great advantage of instruction from the eminent English architect and discoverer, Mr. Penrose, in Greek architecture, which the speaker characterized as behind, and beyond, and above all others, and as that from which all the others derive their inspiration. The speaker thought that every one who has ever been to Greece, whether to study history, or literature, or sculpture, agrees that being on the spot, touching the soil, is more inspiring and serviceable than any other experience in his life, and that it is only *in situ* that its architecture, above all, can be thoroughly studied. But Greece is to-day, he said, the most inaccessible and remote of all the civilized countries. He closed by appealing to his hearers to endeavor to influence their friends toward subscribing a further sum of $100,000 to the Athenian College, to supply an income for a permanent director for it.



Mr. Littell, of New York, being called on in his turn by the Chair, said he had but a word to say in regard to Mr. Ware's remarks. He thought the Institute should provide first for its own house, and not render itself amenable to the censure of Holy Writ, as denying the faith, and being worse than an infidel.

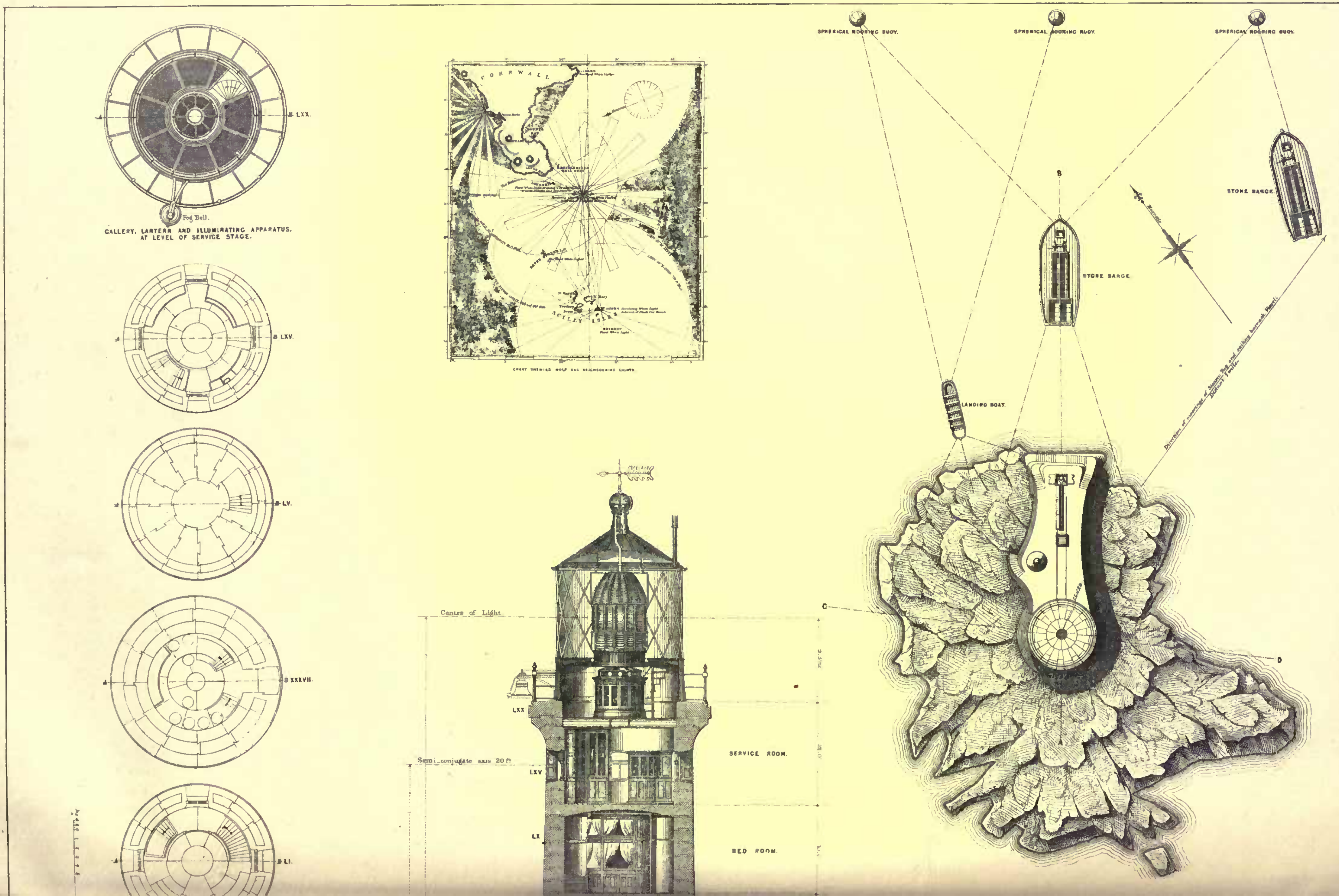
Mr. Nickerson said it was not generally known how easily a week or ten days could be devoted to visiting the remains of Greece by using one of the many lines of steamers running thither from Italy.

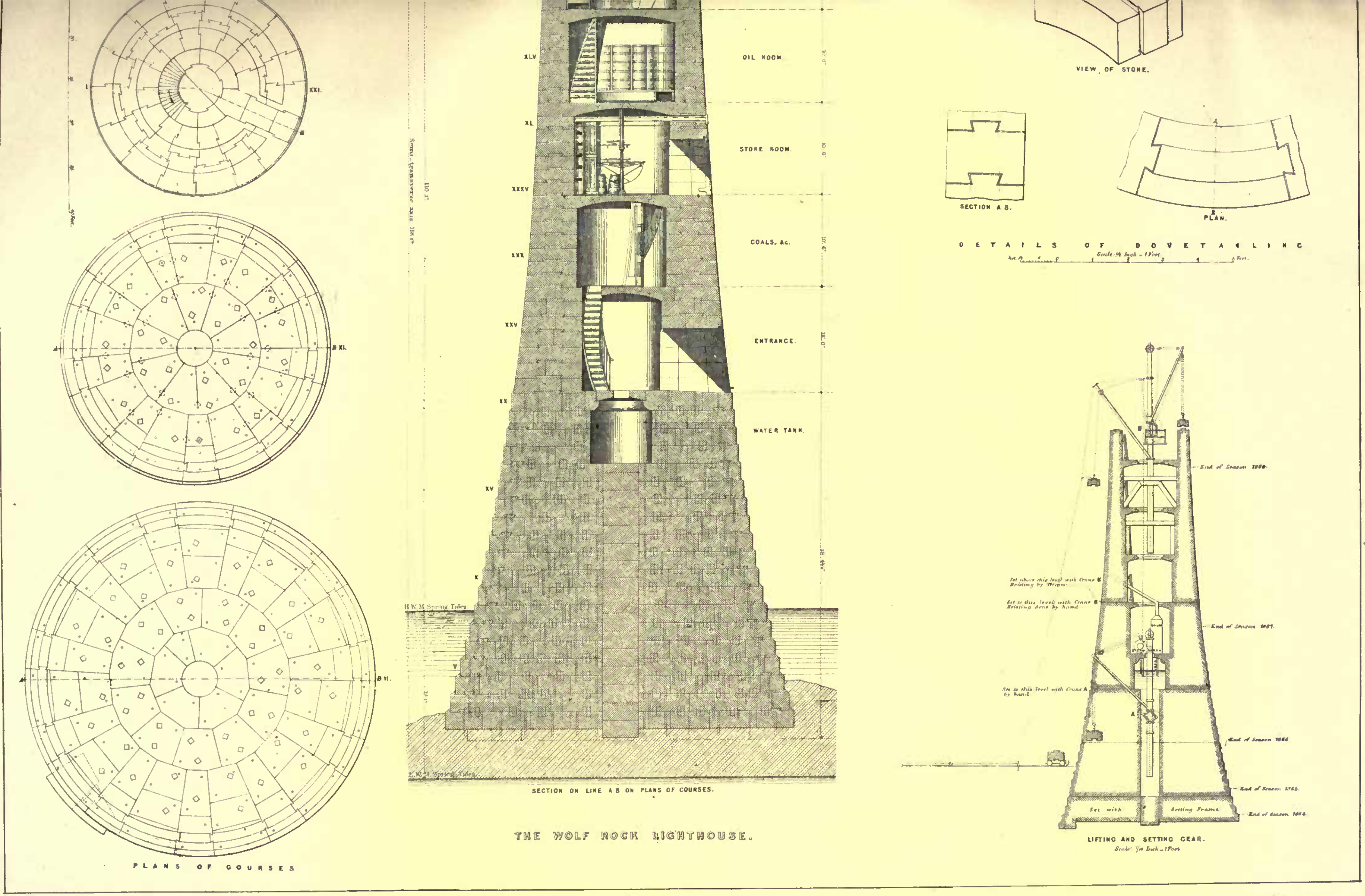
Mr. John Beverly Robinson, President of the Architectural League of New York, gave some account of that organization, which the Chair, in calling on him, had characterized as having done very much for good architectural work in that city. The speaker claimed that the League was in reality the child of the comparatively venerable Institute. Its first inception took place some six years ago, and during that time it had died once, or rather had suffered a suspension of vitality, and been resuscitated. It originated in the winter of 1879–80, with six or eight graduates of the Massachusetts Institute of Technology, resident in New York. Fortnightly meetings were successively held in the houses of the various members. Very creditable sketches were made which, on invitation, received the criticism of practising architects of the city, and which became the property of the host of the occasion. The basis of membership was very exclusive. But, as the members became engrossed with professional duties, this volunteer work became increasingly onerous, and in the winter of '82 and '83 quorums could not be secured. The League did not, however, disband, but remained inactive till about a year ago, when it was resuscitated on a wider basis than before, the actual practice of architecture being no longer a desideratum. It now includes amateurs, painters and decorators, as well as one lawyer. Its old membership of twenty-five or thirty, is now increased to seventy-five. The meetings are monthly, and are preceded by a dinner which takes away the stiffness. The League has charge, and probably will continue to have charge of the exhibition of architectural drawings, so successful last year, and this of itself the speaker considered a sufficient reason for the existence of the organization. It includes a great many very high aims in its constitution, such as the formation of a protective association, the establishment of scholarships and such like, and its future he would leave to the imagination of his hearers.

Mr. Frederick, of Baltimore, endorsed Mr. Stone's remarks as to the necessity of bringing the Institute home, nearer and dearer with every day, to every architect's practice. He contrasted the sometimes menial duties of a lad entering an architect's office thirty years ago, with the era that was now opening on students. He referred to the various architectural associations springing up all over the country, and said he looked forward to the day when they would not be separate organizations except in name, but would be one in body, as now in unity with their mother, the American Institute of Architects. Many of the members of these various societies are already members of the Institute, and he hoped yet to see the latter reaching in reality as well as in name from the shores of the St. Lawrence down to the Rio Grande, and from the Atlantic to the Pacific.



Heliotype Printing Co. Boston.


GALLERY, LANTERN AND ILLUMINATING APPARATUS, AT LEVEL OF SERVICE STAGE.
Fog Bell.
LXX.
LXV.
LV.
XXXVII.
LI.
CORNWALL
SCILLY ISLES
SPHERICAL MOORING BUOY.
SPHERICAL MOORING BUOY.
SPHERICAL MOORING BUOY.
STONE BARGE.
STORE BARGE.
LANDING BOAT.
B
C
D
Centre of Light
Semi-conjugate axis 20 ft.
LXX
LXV
LX
SERVICE ROOM.
BED ROOM.



SECTION ON LINE A B ON PLANS OF COURSES.

PLANS OF COURSES

LIFTING AND SETTING GEAR.

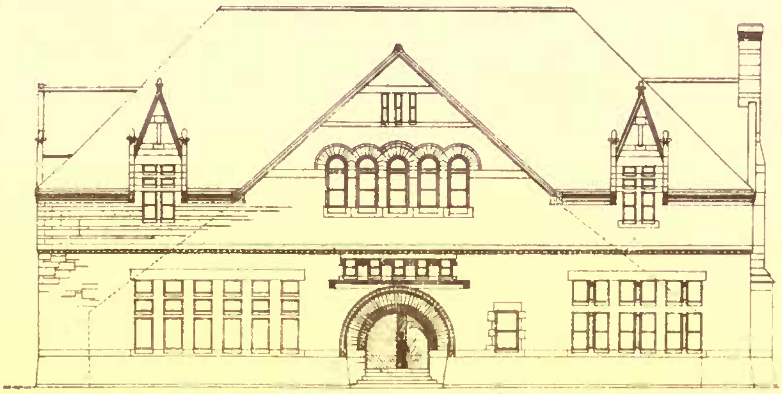
Scale 1/8 Inch = 1 Foot

THE WOLF ROCK LIGHTHOUSE.

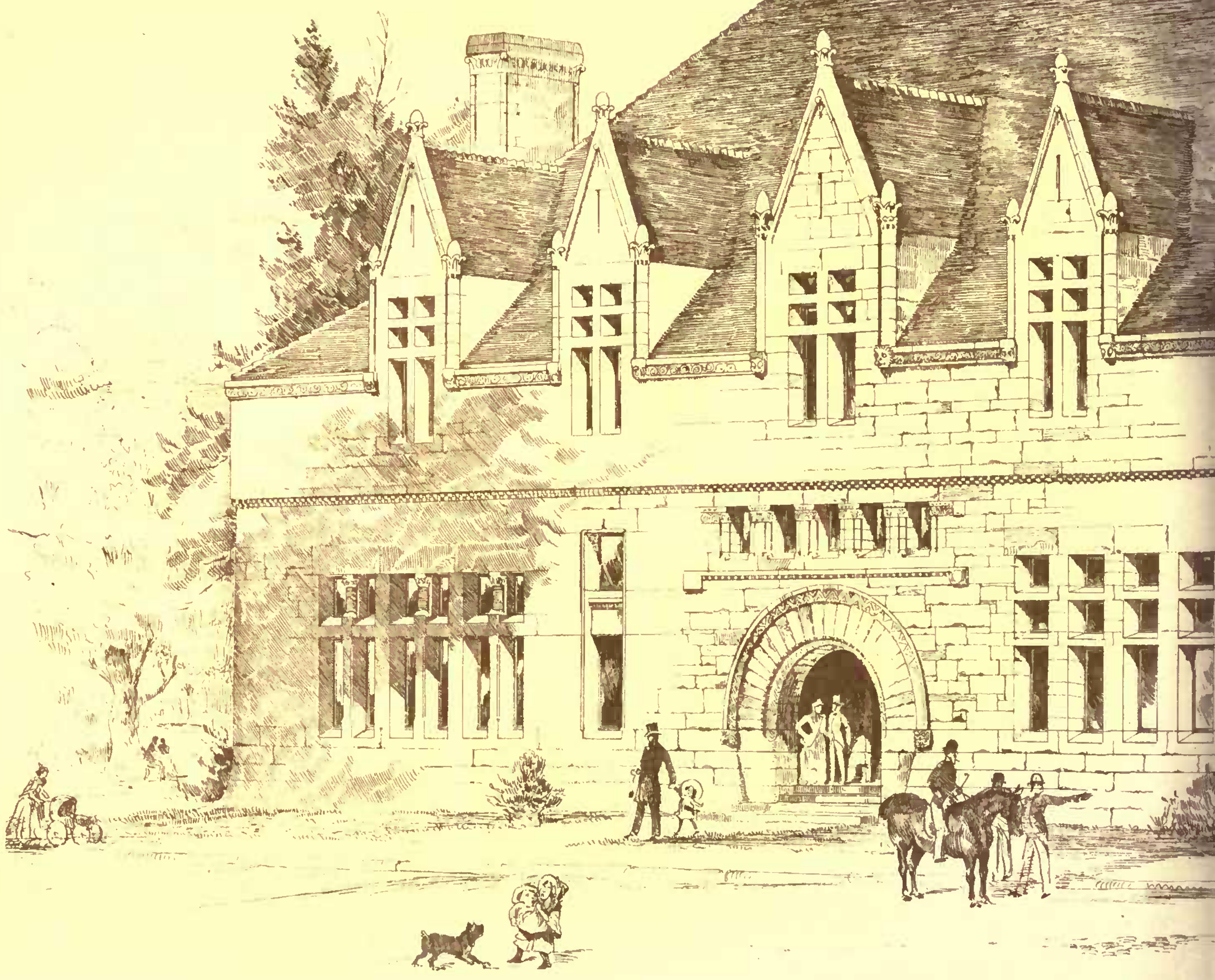
Heliotype Printing Co Boston

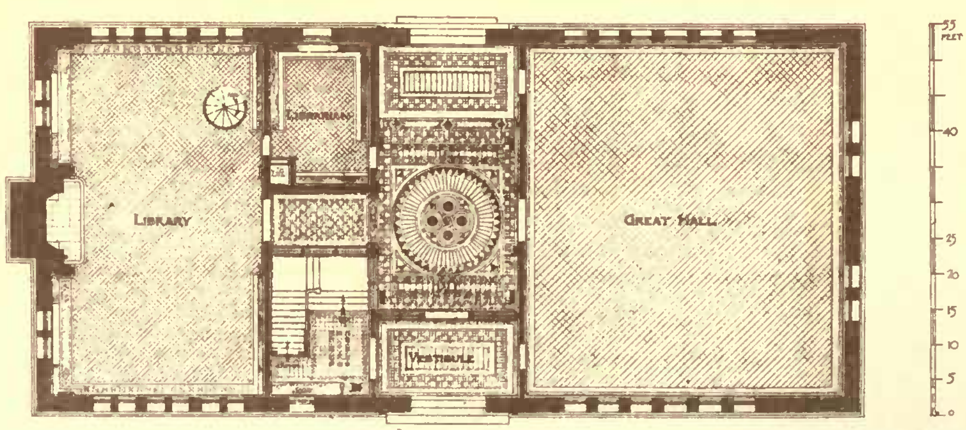
DESIGN FOR BUILDING FOR HORTICULTU[RE]

SHEPLEY, RUTAN & COOLIDGE, ARCHITEC[TS]
BROOKLINE, [...]

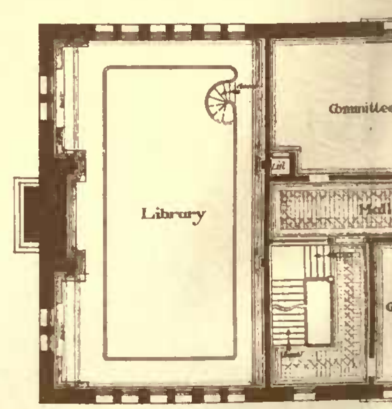


PUBLIC GARDEN ELEVATION





PLAN OF FIRST STORY



PLAN OF

…C°.

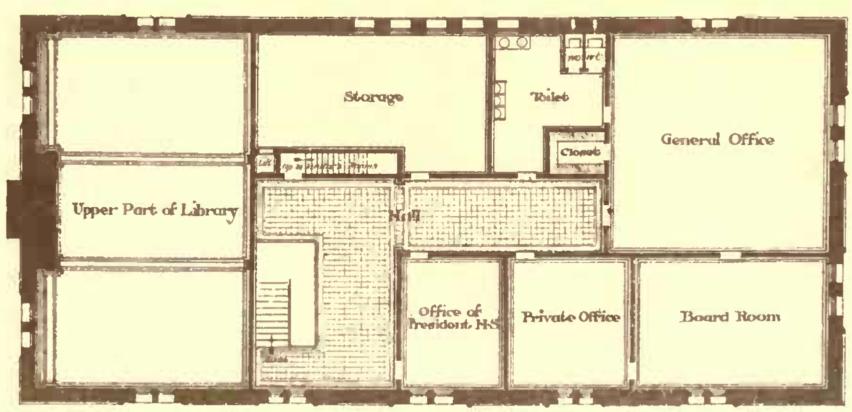
…CIETY AND PARK COMMISSIONERS, BOSTON, MASS.

FIRST STORY PLAN SHOWING MARQUETTE ANNEX.





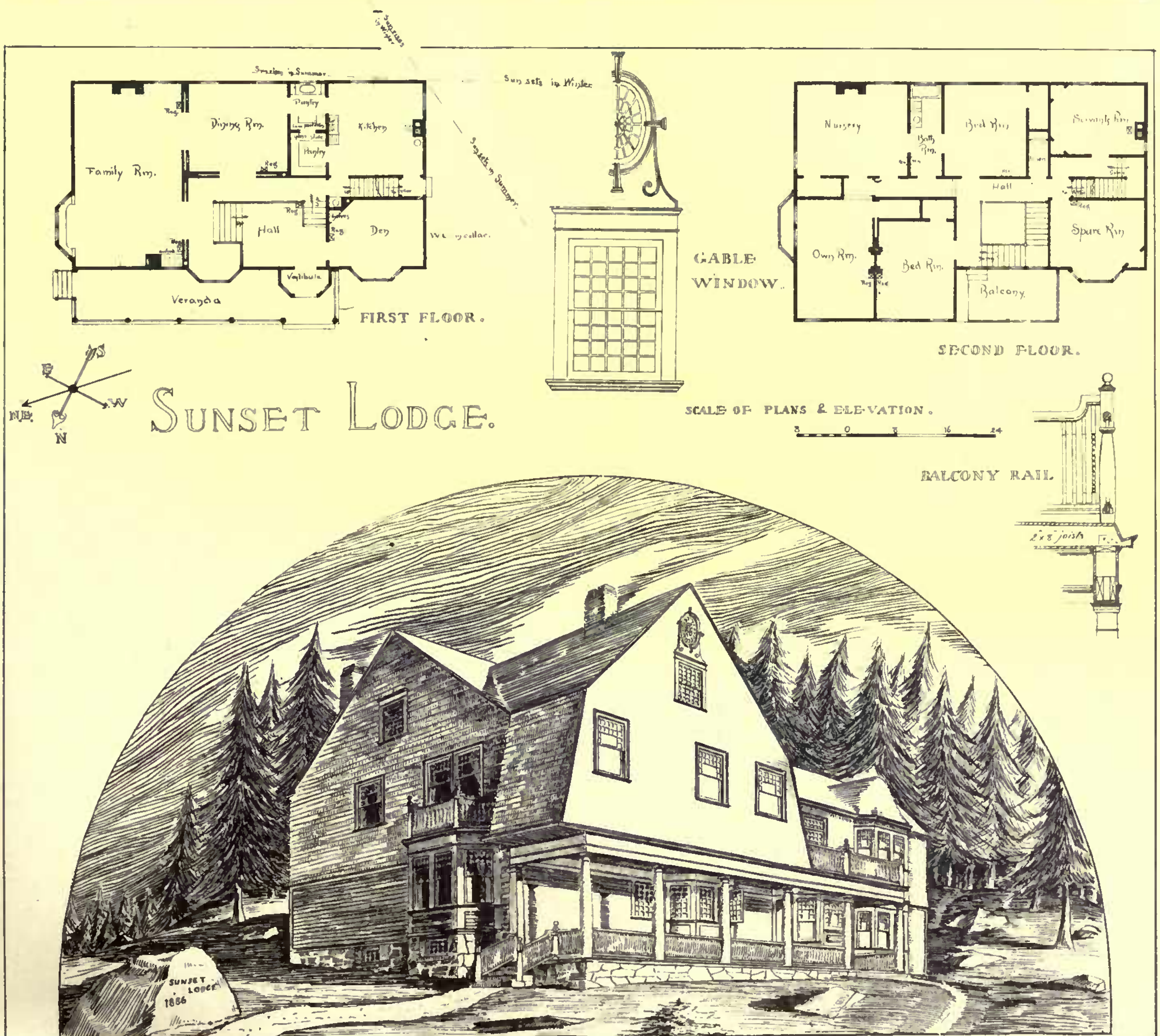
…Story.



Plan of Second Story.

Heliotype Printing Co Boston





Heliotype Printing Co Boston

Mr. Hazlehurst, of Philadelphia, gave a humorous description of that city of brickwork, and described the ups and downs of its Institute Chapter, the later success of which had come from the adoption of the social system of combining the meetings with a culinary basis.

Mr. Bell, Supervising Architect of the United States Treasury Department, returned to the topic he had introduced in the business sessions of the Convention; urged the propriety of taking measures to provide the Institute with a permanent home; and stated, with reference to the bill of the Institute and Western Association of Architects, for a reformed method of procedure in the architectural service of the Federal Government, that he was fully, and always had been fully, in accord with the Institute as regarded their main intentions in that matter, though he differed as to some details. He should render the committee on that bill every assistance in his power consistent with his position as an office-holder under the Government. He had enjoyed the occasion extremely, and regretted that it occurred but once a year.

Mr. Bloor read a telegram from the Secretary, Mr. Mason, regretting his unavoidable absence, and tendering his heartiest wishes for the Institute and the occasion.

On motion of Mr. Hunt the thanks of the Institute were tendered to Secretary Mason for his very valuable and very kind, because unpaid, service during nearly three years, and his health, with that of Mrs. Mason, was drunk standing, with much enthusiasm.

Mr. Myer, of the *Sanitary Engineer*, of New York, made some short and humorous remarks, and Mr. McLean, editor of the *Inland Architect*, of Chicago, spoke at length from the point of view of the conductor of a technical organ, saying the architects could not get along without the illustrations of the architectural periodicals.

Mr. Sidney Smith, of Omaha, Neb., said that Mr. Root did not know where the West was. Chicago was not in the West at all. He had come fifteen hundred miles to attend the Convention, and was very glad he came. Within twenty-five years the Indian had his tepi and the buffalo grazed where some of Omaha's finest structures now stand. The forerunners and maintainers of civilization are the architects. Some there present had practised nearly fifty years. He belonged to the British Institute of Architects, which embraced hundreds of members who had practiced for fifty or sixty years. There are monuments of building genius now being erected in this country which will last for the next ten generations. The "Wild West," the prairies, will then be known no more.

Mr. Briggs, of Connecticut, said he felt as if he were an orphan, because he belonged to no Chapter. In his place, Bridgeport, there were not enough men to form a Chapter. He thought the Institute should make great efforts to overcome some of the abuses of the profession, as, for instance, by the legal establishment of the compulsory examination of architectural students before being allowed to practise.

Mr. Walter, of Scranton, Pa., said, that during his practice of ten years he had constantly looked forward to being enrolled as a member of the Institute, and now that he had lately become one, it was a great privilege to him to meet the Nestors of the profession.

Mr. Moser, of Washington, spoke of the progress of architecture in the South. He had begun professional life in an architect's office, but had afterwards practised fresco-painting, when it was said of him that he was no painter, but an architect. Later on, he had resumed architecture, and was told he was no architect, but a painter. He spoke warmly of the Institute, as the mother of all the architectural associations in the country, and said he feared nothing for it. The Institute will grow as the profession grows. The speaker then branched off into an account of the material resources and prospects of the South, outside of the field of the building art.

Mr. Root, of Chicago, again took the floor and was the last speaker. He said he wished to interpose a word on behalf of Chicago, as the place for the next Convention of the Institute. Should the Board of Trustees consider the proposition favorably, it would confer the greatest possible honor upon the architects there, and he could promise for them that they would try to reciprocate, by every means in their power, the kindness their delegates had received from the Institution.

A. J. B.

THE ILLUSTRATIONS

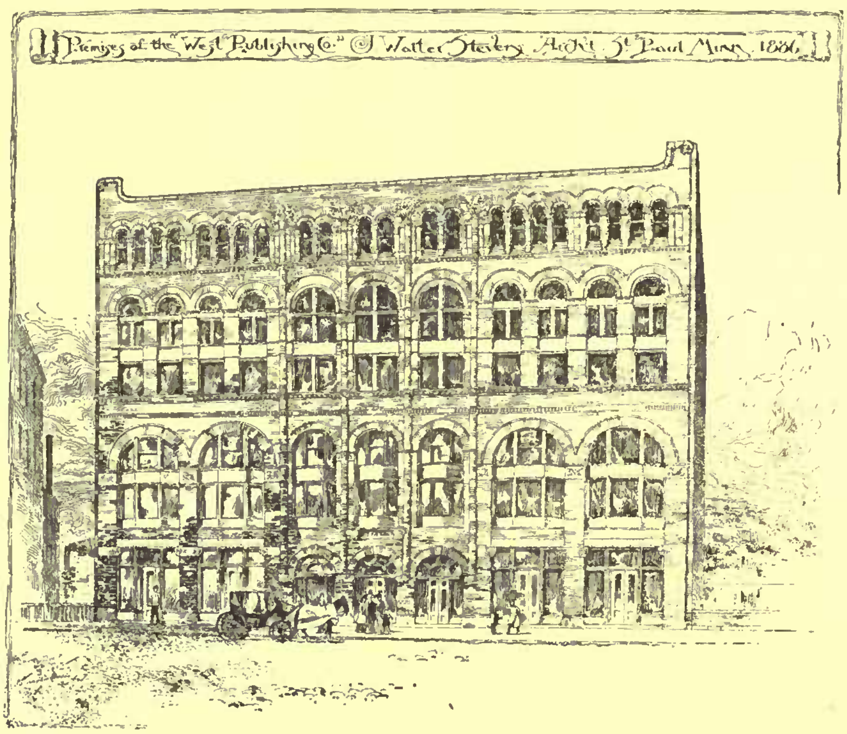
[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE ROTCH TRAVELLING-SCHOLARSHIP DRAWINGS. — PLATES XL, XLI, XLII.

[Issued only with the Imperial edition.]

PROPOSED BUILDING FOR THE MASSACHUSETTS HORTICULTURAL SOCIETY. MESSRS. SHEPLEY, RUTAN & COOLIDGE, ARCHITECTS, BOSTON, MASS.

It is proposed that this building shall occupy a site on the Boylston-street side of the Boston Public Garden, and by so doing deprive the public of a portion of its already too scanty pleasure-ground. Pleasant as it is to lay before our readers a creditable piece of architectural design, we should not do our full duty did we not enter our protest against such a sacrifice of the rights of the working-classes, to say the least, who, we may safely assume, are but slightly interested in the convenience and welfare of a very useful and — to many — pleasure-yielding society to be sure, while they do derive pleasure and profit from every foot of the Public Garden to which they have unrestricted access. As between the proposed site and one, say, near the Boylston-street entrance to the new park, we can see many arguments in favor of the latter.



WOLF-ROCK LIGHT-HOUSE, OFF LAND'S END, ENGLAND.

FOR description see article on "Ancient and Modern Light-houses," elsewhere in this issue.

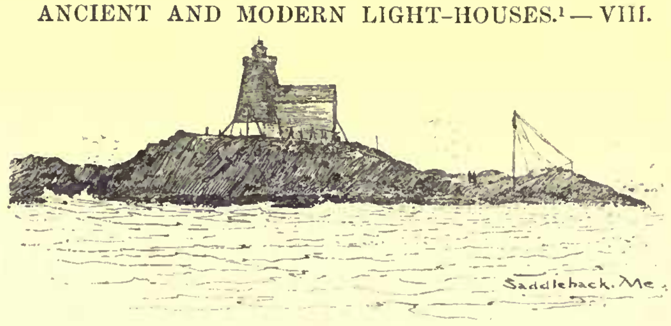
COMPETITIVE DESIGN FOR A $5,000 HOUSE SUBMITTED BY "*Sunset Lodge.*"

"AGRICULTURE." DESIGNED BY MR. LOREDO TAFT, SCULPTOR, CHICAGO, ILL.

PREMISES OF THE WEST PUBLISHING CO., ST. PAUL, MINN. MR. J. W. STEVENS, ARCHITECT.

EIGHT stories of this building were built between the last of June and Dec. 20, 1886, at which time the incomplete building was occupied. Cost, $85,000.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — VIII.



LONGSHIPS AND WOLF ROCK.

IN 1795 a light-house on Longships Rock and beacons on the Wolf and Rundlestone were erected in order to mark the dangers of the coast near Land's End, England. In 1841 a light-ship was moored in forty fathoms of water off the Sevenstones Rocks, midway between the Land's End and Scilly. These were all works of considerable difficulty.

The Longships' light-house is a granite structure, but as the light is only seventy-nine feet above high water of spring tides, the lantern,

[1] Continued from No. 578, page 42.

owing to the terrific seas, was so much under water during stormy weather, that it was difficult to determine the character of the light.

As it was not considered safe to raise the tower to a sufficient height to render the lantern safe from the heaviest seas, it was determined to replace it by a granite column one hundred and ten feet above the water. The work was commenced in 1869 and was completed, with the exception of setting the lens, in 1873.

There is an arrangement for marking the dangers of the Rundlestone Rocks to the southward and the Brissons Rocks to the northward, by sections of red light. As these rocks are well out from land they were great dangers to navigators.

The Rundlestone lies about four miles to the southeastward of Longships, and is three-quarters of a mile from shore. It measures about seventeen feet nine inches by eight feet nine inches at low water of spring tides, but the only available portion for a beacon is a place about four feet in diameter at a level of seven feet above low water of spring tides. The rock, composed of hard grey granite, forms part of a dangerous group of shoals, and is the only portion visible at low water.

The beacons mentioned as having been placed on the Rundlestone and Wolf rocks were wrought-iron poles about four inches in diameter, sunk into the rocks and held in their places with melted lead. That on the Wolf was twenty feet high and supported by six wrought-iron stays; the one on Rundlestone was shorter, as there was not room for the stays. Both were surmounted by spherical iron cages to make them distinguishable. Both were soon carried away by the sea.

Another beacon was placed on the Rundlestone with great difficulty and danger during the years 1841–43: it was twice carried away, and finally a bell-buoy of peculiar construction, designed by Sir James N. Douglas, was substituted.

Wolf Rock is composed of hard feldspathic porphyry; its highest part is seventeen feet above low water of spring tides, high tides rise two feet above it. The water is twenty fathoms deep on all sides, except on the southeast, where a shoal extends for a considerable distance.

It took from 1836 to 1840 to erect a beacon on this rock. During these five years the men were only able to work three hundred and eight hours, and the cost of the work was over $55,000. The mast, which was of selected English oak, one foot in diameter, was carried away as early as November of the last-mentioned year. It was decided to replace it with a wrought-iron one seven and five-eighths inches in diameter, but no opportunity occurred until August, 1842. The succeeding winter it was bent three feet from the perpendicular, and in 1844 was broken off. The next July a nine-inch mast was placed, and the globe reduced to a diameter of four feet. This stood until 1848. In 1850 another nine-inch mast was put in, the globe reduced to three feet, and an iron cone filled with concrete was built round it; this stood for thirty years, until taken down during the construction of the light-house.

From the preceding statements some idea can be obtained of the tremendous seas to which this rock is exposed.

The first survey for the purpose of determining the exact position of the proposed tower was made by James N. Douglas in 1861. He landed upon the rock and made the best use possible of the short time he could stay; but the sea, getting up meanwhile, put a stop to his work, and as a boat could not with safety approach the rock owing to the increased swell, he was hauled on board through the surf by a line fastened around his waist. This mode of taking the workmen from the rock, when caught by a sudden change of weather and increase of surf was frequently employed afterwards under similar circumstances.

In March, 1862, the working party was landed and commenced work on the foundation pit. The insecurity of the foothold, and the constant breaking of the surf over the rock, rendered great precautions necessary for the safety of the men. Heavy iron stanchions were sunk into the rock around the site for the foundation, to which were attached safety-ropes within easy reach of the men. An experienced man was stationed on the summit to look out for the seas, and would give warning of such waves as would be likely to sweep the rock, when the men would hold on, head to the sea, while it washed over them. Picks, hammers, and jumpers, some exceeding twenty pounds in weight, were frequently carried away.

During the first year, 1862, only twenty-two landings had been effected and eighty-three hours of work obtained during the season, although not a single opportunity had been lost to work, even if only for half an hour. The work was confined to blasting and cutting out the foundation pit for the tower, and in the erection of the landing-platform.

By the end of the season of 1864, thirty-seven stones of the first entire course or second course of the tower were set, the landing-platform was nearly completed, and the landing-derrick or crane erected on the end of it.

This landing-platform was constructed on account of the great difficulty of landing upon the Wolf, which can only be effected on the northeast side, and even there the surface is rugged and without any vertical face for a boat to approach. As the material for this platform could only be landed from boats, small granite ashlar set in cement, similar to old English bond, was adopted, with the exception of some larger ashlar used for the steps and coping, and some rubble filling obtained from the foundation pit. The stones were each 24″ x 12″ x 6″ rough pick dressed and laid in fresh Medina Roman cement. Frequently tides which were not low enough to allow work on the foundation pit allowed the men to work at this platform, which greatly facilitated the erection of the light-house and proved of permanent value, from the convenience it affords for landing and embarking at times when it would be impossible without it.

The accompanying plate shows the amount of work accomplished each working season up to 1868. The last stone was successfully laid in 1869. The general internal arrangements are shown on the section of the tower. The same plate shows the methods of dovetailing adopted. The step-ladders for ascending from floor to floor, and the partitions between the rooms and staircases are of cast-iron, and the use of wood for fittings has been avoided as much as possible as a precaution against fire. The doors, windows and storm-shutters are constructed of gun-metal. The windows of the service-room are specially arranged for the air-supply of the lantern by means of valves which admit the air above the heads of the keepers, and upwards through an iron grating in the lantern floor.

The relative position of the mooring buoys, barges and landing-boat, when at work, are shown on the plan. S S are the stone barges, L the landing-barge, and M M the mooring buoys. Each barge, when at the landing-crane, was moored, stem and stern, with ten-inch coir-hawsers, and the stern hawsers, which were the shorter, were frequently parted, notwithstanding their large size.

The barrack schooner, containing the resident engineer, his assistants, and the working party, was moored east-northeast from the rock, at a distance of three-fourths of a mile, and remained there as long as there was any opportunity of doing any work.

The landing-boat was built diagonally, of two five-eighths inch thicknesses of elm plank, without timbers or floors, and was provided with a landing-deck and mast forward. This deck and the gunwale were covered with rough rope matting, to afford a good foothold in jumping from or into the boat. Each workman was provided with a life-belt, which he was required to wear while landing on or embarking from the rock, and it was frequently necessary for the safety of the men that they should wear them while at work.

A similar landing-boat is still used. It is warped in by means of a line made fast to a buoy astern and two lines from the bow, the latter being managed by men on the rock. The person who is to land stands on the landing-deck forward, holding fast to the stout mast or stake, and when he is warned by the coxswain that the proper instant has arrived, he seizes the rope lowered from the derrick-boom on the landing-platform, places his foot in a loop at the end, and is quickly hauled up by the men at the winch on the rock.

When the keepers are relieved it is sometimes impracticable to drop them into the boat; in such cases they are hauled to it through the surf.

This light-house contains, exclusive of the platform, 44,506 cubic feet of granite, weighs 3,296 tons, and cost a little over $300,000. It is one of the most striking examples of light-house engineering of which the Eddystone furnishes the type. It was lighted for the first time on January 1, 1870.

The actual time snatched from the sea which the men could work is shown in the following table: —

Year.	No. of landings.	Hours of work.
1862	22	83
1863	39	206¼
1864	42	267
1865	41	256
1866	31	224
1867	40	313¼
1868	30	276¼
1869	21	194¼
Total	266	$1814\frac{1}{12}$

MAPLIN SAND LIGHT-HOUSE.

Mr. Alexander Mitchell, of England, invented the screw-pile for submerged sand-banks; it is described by him as a "project for obtaining a much greater holding power than was possessed by any pile or mooring then in use; the former being nothing more than a pointed stake of considerable size, easily either deposited in or extracted from the ground. . . . The plan which appeared best adapted for obtaining a firm hold of soft ground or sand was to insert, to a considerable distance beneath the surface, a bar of iron having at its lower extremity a broad plate or a disk of metal in a spiral or a helical form, on the principle of the screw, in order that it should enter into the ground with facility; thrusting aside any obstacles to its descent, without materially disturbing the texture of the strata it passed through, and that it should at the same time offer an extended base, either for resisting downward pressure or an upward strain."

In 1838, the inventor and his son built for the corporation of the Trinity House the foundation of the light-house on Maplin Sand, at the mouth of the Thames. This was the first screw-pile light-house, so far as the foundation was concerned, although the one at Fleetwood was actually completed before the Maplin.

It is an hexagonal structure, with one central and eight exterior piles. The piles were driven vertically; but above the water-line they bend toward the centre, and incline in a pyramidal form to the lantern floor. The screws are four feet in diameter; the piles five inches, and they support cast-iron columns twelve inches in diameter, which are strongly braced.

The principle of the screw-pile has been very largely used in light-house construction in the United States: it is specially applicable to

inland waters, not exposed to very heavy seas, where the bottom is such that a screw-pile can be forced through it. In places where



there is much running ice, it has been found advisable to protect these structures against the impact of the ice, either by a wall of riprap, or by ice-breakers detached from the foundation.

FREEZING SOFT MATERIAL FOR EXCAVATION.



BAS-RELIEF ON L'IMPRIMERIE NATIONALE, PARIS.
— FROM THE REVUE DES ARTS DÉCORATIFS.

At the three hundred and fifty-sixth meeting of the Society of Arts, held at the Institute of Technology on Thursday evening, January 27, Mr. Chas. Sooysmith, of New York, read the following paper on the Poetsch process which is officially reported in the *Boston Transcript*.

The subject on which it is my privilege to address you has become known to engineers as the "Poetsch Freezing Process." The inventor was Mr. Herman Poetsch, a German mining-engineer, of no particular note until he conceived and made a practical success of the method which bears his name. He had something to do with sinking a shaft near Ashersleben, Germany, to a vein of coal where, after excavating about one hundred feet, a stratum of sand, eighteen feet thick, overlying the coal, was encountered. It occurred to Mr. Poetsch that the great difficulty occasioned by the influx of water through the sand could be overcome by solidifying the entire mass by freezing. To accomplish this, he penetrated the sand to be excavated with large pipes sunk entirely through it and a foot or two into the underlying coal. These were placed in a circle at intervals of a metre and close to the periphery of the shaft. They were eight inches in diameter and closed at the lower end. Inside each of these, extending nearly to the bottom, and open at its lower end, was a pipe but one inch in diameter. This system of pipes was so connected that a closed circulation could be produced down through the small pipes and up through the large ones. An ice-machine, such as is used for cooling in breweries, making ice, etc., was set-up near by and used to keep at a temperature below zero, Fahrenheit, a tank filled with a solution of chloride of magnesium, the freezing point of which is 40° below zero, Fahrenheit. The solution so cooled was circulated through the system of ground pipes described.

Thermometers were placed in pipes, sunk into the mass of the sand, and the following results were observed: The temperature of the mass before the circulation of cold liquid was started was 51.8° Fahrenheit. The circulation was kept up and the temperature of the mass was rapidly lowered, so that, at the point where this temperature was taken, which must have been not far from one of the pipes, the mass was frozen the third day after circulation had commenced. The freezing took place, of course, soonest about each pipe, beginning first near the bottom, where the inflowing solution was coldest, and extending outward in radial lines. The cylinders, or, more correctly speaking, the frustums of cones about the pipes, finally met, thus forming a continuous frozen wall, inside of which the material to be excavated was removed without any possible danger from caving-in or inflow of water. The freezing, it was found, had taken place three feet into the coal, and to a distance six feet outside of the circle of pipes. The circulation of cold fluid was kept up until the excavation and walling-up were complete.

This brief description of the first work suffices to explain the method in its simplest application. Other shafts were undertaken, and where much difficulty is encountered in passing through water-bearing strata the process for this purpose is now coming into general use in Europe. For the shaft sunk in Germany, ice-machines with a capacity of fifteen tons of ice per day — or, more scientifically speaking, capable of producing 1,750,000 thermal units — have been used. Of course, if we knew the specific and latent heat and the conducting capacity of the material we wish to freeze, we could determine exactly the number of thermal units we should have to extract to solidify the mass. Taking a mass at a temperature of 25° centigrade, consisting of sand and water in the proportions of three to one, and assuming that no heat is supplied to the mass to be frozen, we would have to extract 1,168,002 thermal units per cubic yard to freeze the material. This would permit us, with an ice-machine of thirty tons capacity, daily to freeze fifty-four cubic yards per day. And knowing the cubical contents of the mass we wish to freeze, we could in this way determine the time requisite for the freezing. In most cases with the machines that would be used the frozen wall would be formed in ten or fifteen days. As an actual fact, considerable cold is dissipated through the earth. It is very fortunate for us here that the soils of the earth and still water are comparatively poor conductors, the conductivity of water being about one ninety-fifth that of copper. It remains for some of our students who have the time, to determine the rate through different kinds of earth saturated with water — and also to determine the strength of these when frozen, that, knowing the strain upon our wall, we may know how thick it must be to surely resist this strain.

In sinking shafts, as the radial lines of conductivity from the pipes converge towards the centre of the shaft, and there is no way for the cold to get out, so to speak, the entire mass inside of the circle of pipes freezes, while the desired ice wall is being frozen. This, of course, makes the excavation slow and expensive. Frozen sand and water look like sandstone, and seem almost as hard. With pick and shovel, workmen in the bottom of a shaft will do very well if they average an inch in depth per hour. Of course, the idea of thawing the interior mass at once suggests itself. Pipes for the circulation of hot brine could be inserted before freezing. My impression is, however, that blasting will prove the preferable method.

Probably the greatest service which this invention will render will be making practicable the construction of subaqueous tunnels which could not otherwise be built.

In applying the freezing method to the construction of a tunnel there are a number of ways of arranging the ground pipes. Where the depth of water is not excessive, and where navigation or current in the stream do not bother, it would seem simplest and best to put pipes down from above, in vertical or inclined positions, placing them in rows on either side of the proposed excavation. They can be incased in non-conductors of heat, except the portion about which it is desired to freeze. The circumstances where this manner would be practicable will not often occur. We are more likely to meet with cases like that of the Hudson River Tunnel, where the freezing pipes must be put in from the completed portion of the tunnel, reaching forward beyond the heading. The problem of managing these pipes has been the occasion of a great deal of study, because the heading must be kept frozen, and pipes for further freezing must be kept ahead of this. Then, too, the pipes must be so arranged that they will not interfere with putting in the permanent lining.

The result of my own study on the matter is to place the freezing-pipes horizontal and parallel and in a circle near the periphery of the tunnel, and somewhere from three to six feet apart, as experience shall prove to be the best distance. The brick lining is kept along pretty close up to the excavation. Back at a convenient distance from the heading, in the finished portion of the tunnel, I would have a frame which can be readily moved forward at intervals. Against this frame will be worked the hydraulic jacks, which will be employed to push the pipes forward. Occasional bricks can be temporarily left out of the lining to form offsets which can be used to hold the frame in place. Each of the large pipes would have a small pipe inside, extending nearly to the point where a diaphragm provided with a great number of small holes would form an obstruction to the circulation. Another small pipe would pass the entire length of the larger one and through this diaphragm.

The ice-machine may be located outside, and the cold solution brought through a well-wrapped pipe to the heading. Flexible connection could be made with the system of pipes so that the cold circulation can be maintained throughout the entire length of the pipe,

except from the forward point back to the diaphragm. There will be no tendency whatever for the circulation to penetrate beyond the diaphragm. The object of thus limiting the circulation is to prevent possible freezing ahead of the pipe. When the excavation has progressed so that any one of the pipes should be pushed forward, the circulation of cold fluid in it is temporarily suspended, and for a few moments warm brine is circulated throughout the entire length of the pipe, being permitted to flow in through the longer small pipe. The result would be the thawing of a film about the large pipe. While thus loosened the pressure would be put on the hydraulic jack in which the large pipe terminates at the inner end, and by this means the pipe forced forward, say ten or fifteen feet. The circulation of the cold solution would then be resumed. The frozen mass would form a guide for the pipes.

In the case of the proposed subways under Broadway, New York City, the availability of this means of preventing with absolute certainty any lateral movement of the material about the foundation of the buildings, ought to remove all fears of this danger in connection with that enterprise. Where necessary, in a case of this kind, a row of pipes could be sunk close to the curb line, and a frozen wall thus placed between the buildings and the street to be excavated.

This recalls another work of great importance that had to be done with extreme caution, which could have been accomplished with the greatest of security by the new method. I refer to the spreading of the foundations of the Washington Monument, at Washington. Since the monument has been completed there has been considerable said about a stratum of sand which is said to exist below the foundation, and which it is feared may at some time be penetrated, and the weight of the monument squeeze it out laterally. If this danger really exists, how easy it would be to freeze a wall about the monument, excavate through this stratum, and put in a permanent barrier to its exit. The freezing process removes also the chief difficulty in the construction of subaqueous tunnels, by sinking them in sections from above, as has frequently been proposed. The chief difficulty in this latter method has always been to make the connection between the sections. To do so by freezing would be readily accomplished by providing the ends of the sections with a pipe running around them outside the tunnel space; then when it is desired to make the joint between two sections, after filling the space between them with mud, this latter could be frozen, thus forming a barrier to the influx of water while the permanent joint would be made. Another application has occurred to me in studying the difficulties that may have to be overcome in building a railroad tunnel between Canada and the United States, under the St. Clair River, where my firm is now driving a small experimental tunnel. Under the deepest portion of the river there is scarcely enough material intervening between the rock and the bottom of the river to leave a safe thickness overhead while the excavation is made. It may be necessary to provide what I may call an immense turtle-back, which could be lowered on to the bottom to serve as a temporary roof. To be effective it should be provided with low sharp sides, and the entire under surface furnished with channels for the circulation of the cold fluid, so that when lowered on to the bottom of the river the thin roof that would have been dangerous could be converted into a frozen solid, which would perfectly protect the work underneath. Still another application occurs to me in connection with this work. The material at the centre line of the proposed large tunnel is such that we anticipate no difficulty whatever in driving the six-foot heading which we are now commencing. Better than the turtle-back I have mentioned, it may be to use this trial tunnel as a means of freezing for a sufficient distance about it to permit the excavation of the large tunnel entirely in frozen material. To do this, a car with coils one or two hundred feet long, *i.e.*, the coil that length, not the pipe, in which the vehicle of cold could be circulated, could be introduced into the small tunnel and kept immediately in front of the excavation while this latter is made and the permanent lining put in. I believe that no difficulty would be found in freezing fifteen or even twenty feet radially out from this small tunnel by using means of ample capacity. Thus it will be seen that the construction of under-water tunnels, one of the most hazardous and expensive kinds of engineering, has a resource of incalculable value in this new method.

In the construction of deep and difficult bridge foundations, it is likely also to render great service.

Where a foundation is to be obtained on a bed-rock which is very unequal in elevation, and is overlaid by material hard to excavate on account of water, the freezing method is admirably adapted to cope with the difficulties encountered. Where such a pier is to be built in the water, a bottomless caisson or a coffer-dam would have to be first placed in position, and the freezing-pipes put down through or inside the same. Such a coffer-dam may be made with less than the usual care, and earth of some kind filled in around the pipes and frozen. Another case in bridge construction, where the process could be most advantageously used, would be where it is desired to found a pier on bare rock, where the water is of considerable depth. An open caisson could be sunk on to the rock, being first provided around the bottom with a pipe through which a cold liquid could be circulated after the caisson was settled to place, and sand dumped in about the space between the caisson and bed-rock. When this would be frozen, it would perfectly shut off any entrance for the water, which could then be pumped out and the bed-rock laid bare. The supreme advantage, however, of the process in bridge work will be in obtaining foundations where a trustworthy resting-place is beyond the depth attainable by the pneumatic process, and there are many such places in this country, where bridges are or will be badly needed. It has one disadvantage in comparison with the pneumatic process, in any case where the two methods might otherwise be equally desirable; that is, the excavation has to be completed before any of the permanent work can be started. Whereas, in obtaining a foundation by pneumatic process, the caisson itself becomes a part of the pier, and the masonry is laid on the caisson, while the latter is undermined and sunk. In other words, the pneumatic method would require less time.

It has, however, the disadvantage that the caisson cannot always be sunk in the exact position desired, and the foundation is therefore generally superfluously large, adding in this way to the cost. By first excavating to the bed-rock, the foundation could be built in the precise location and of the exact dimensions desired.

Where a ship has been sunk by collision, making it difficult to close the break, so that she could be pumped out and raised, the opening, however irregular, might be readily closed by freezing.

To accomplish this, it would only be necessary to lower a coil of pipe into or about the opening, throwing something into the latter to impede the circulation of water, and then circulating the brine and freezing the opening fast. In salt water it would, of course, take a very low temperature to accomplish the freezing. It would not be difficult to make an ice machine to produce an excessively low temperature. Those now made for commercial purposes can produce a working temperature of at least 15° or 20° below zero, Farenheit.

An early application of the new process is likely to be made in sinking a shaft to a bed of sulphur, discovered several years ago in Louisiana. This occurs at a depth nearly five hundred feet below the surface, and to reach it, beds of sand have to be penetrated where the head of water in same is three hundred feet. An effort was made to pass through this, but failed, after an expenditure of, I believe, some two hundred thousand dollars. To sink this shaft, the pipes would either have to be put down the entire length at the start, or else resort would have to be had to some method similar to those mentioned in connection with tunnels; or it might be better to build the upper portion of the shaft so large that near the ends of the first set of pipes put in, an offset could be made, through which a second set could be inserted.

I have now mentioned the peculiar fitness of the Poetsch method for certain classes of work. The chief difficulty in applying it, where there is any difficulty, will be to insert the pipes properly. This difficulty is likely most often to arise from the presence of boulders or logs in the material to be penetrated. It is true this can be overcome by drilling, but it would be very expensive. There has not yet been sufficient experience obtained to enable us to determine the best sizes of ground pipes and the maximum space we dare leave between them. Mr. Poetsch has continued to copy his first success, using eight-inch pipes placed about a metre apart. In some cases the pipes have not been sunk exactly as desired, leaving a space five or six feet between them at the bottom; still the frozen mass was continuous. The fact is that the freezing is due to the cooling of the entire mass in the vicinity of the pipes, and it would seem more a question of total quantity of cold inserted, and distance from the centre of application of this than the distance of the point from any individual pipe.

Another possible difficulty that will occur only in rare cases is the presence of considerable quantities of running water through the material to be frozen, that would thus be a vehicle to carry away the cold as fast as supplied. This difficulty is more likely to be encountered in sinking shafts to existing mines where pumping is in progress. As regards cost of doing work by this process, if we except the expense of the possible difficulties just mentioned, we may estimate beforehand the cost of a proposed work, with more accuracy than by any other method; and we may say the same with regard to the time required. This because of the certainty of removing the greatest contingency in such works, namely, that due to the influx of water or soft material. The enemy is converted to an ally and made to stand guard while the victory is won.

In underwater works accidents very often occur from the failure of machinery. Imagine, for instance, what would have happened to the pier at Havre-de-Grace, that I have been telling you of, had our pneumatic machinery failed, even for a few hours, while we were holding the pier, weighing millions of pounds, on a cushion of air. With a frozen wall several feet above us, we would have been in safety while any conceivable accident to the ice machinery could be repaired, as it would have taken several days, or at least many hours, for dangerous thawing to occur. It has been customary in Europe, and will probably always be advisable, to keep the ice-machine running until the permanent work is put in place.

Difficulty might be anticipated in putting in a brick or masonry wall close to the frozen material. As a fact, no difficulty has been experienced in doing this.

The Old World was a more favorable field than the United States for the development of this process, because the coal fields have been more completely exhausted, and the time was ripe for the invention of a means of reaching the more inaccessible ones. Until three decades ago it was deemed practically impossible to bridge the Missouri or the lower Mississippi, or to obtain adequate foundations in many other places where the difficulties have since been successfully overcome by the pneumatic process. And just as this has rendered easy and of common occurrence the execution of works not long ago

regarded as impossible, so this freezing method seems destined to make a step forward of no less importance.

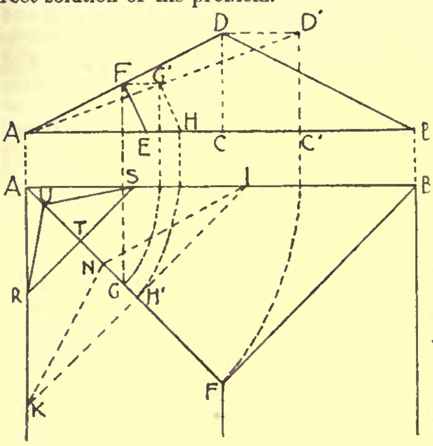
COMMUNICATIONS

TO FIND THE BEVEL OF A HIP-RAFTER.—A CORRECTION.

BOSTON, February 10, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—In your last issue is published the letter of "Anxious," dated January 22d, asking for information as to "how to find the angle" of a hip-rafter. An inspection of the reply to this note of inquiry shows that an error is made therein, which would be liable to disappoint "Anxious" in his search for an economical, rapid or correct solution of his problem.



In the diagram with which the reply is illustrated, and which is here reproduced, *ad* is the *elevation* and *af* the plan of the hip, but neither shows its *true length*, or its *inclination* from a horizontal plane—and consequently *e* does *not* represent the point where a line perpendicular to the axis of the hip and passing through *f* would strike the horizontal plane through the plate.

This point *f* is shown at *g* in plan, and the true length and inclination of the hip are shown at ad^1 on the diagram, in which g^1 shows the position of the point *f* or *g*, and *h* is the true point where the perpendicular through *f* would strike the plane of the plate; *h* is shown at h^1 on plan, and the intersection of the plane which cuts the right section of the hip at *f* with the horizontal plane of the plate, is shown in *plan* at kh^1i. Then, from h^1 laying off $h^1n = hg^1$ (not *fe*), and drawing *kn* and *ni*, we have the angle *kni*, which is the desired angle of the hip, but very different from the angle *rus*, as found in the original diagram.

Respectfully, L. F. R.

THE WEIGHT OF STORED MERCHANDISE.

BOSTON, February 12, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—Some time ago you published a communication from Mr. Edward Atkinson on the strength of floors, in which was given the weights, per square foot, of various substances piled ten feet high. Such information is of great practical value, and I wish the table had been a little more comprehensive. If any of your readers have had occasion to ascertain the weights of other substances, I think they would be doing a favor to the profession by sending their results for publication in your columns.

Among the articles *not included* in Mr. Atkinson's list are the following: Flour in barrels, piled two or three tiers high; sugar in barrels; salt fish; nails in kegs; leather, tanned; hides; hay in bales; grain in bins, etc.

Hoping this will meet with a response from some one of your readers, I remain, Yours truly, F. E. KIDDER.

METHODS OF DEAFENING FLOORS.

MONTREAL, CAN.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—I take the opportunity of the present to ask you a few questions on the following practical points, and I hope you will favor me with an answer in your paper, and oblige.

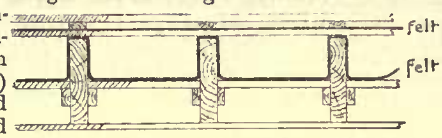
1. In a certain case I did specify a dead floor for a church in the following way:



(1) A common grooved-and-tongued flooring between the joists; (2) poured mortar about one inch around the floor and the sides of the joists; (3) ashes; (4) a common grooved-and-tongued floor one inch thick over the joists; (5) one thickness of tarred felt; (6) the good flooring, grooved-and-tongued and in $1\frac{1}{4}$ inch boards, the floor under the felt put on diagonally with the joists and the last floor crosswise.

2. Now the work has been commenced lately and I have to begin the basement as soon as possible, and, as it is a large church, it is desirable to do the under-floor immediately, even before the roof is on. This is the way we do the deadening, except the felt, here. I find, to that kind of work, a few serious inconveniences: The excess of weight on a large floor; the danger of causing the wood to decay on account of the mortar and ashes, and especially in this case, from the danger of rains, and perhaps frost, at this season of the year.

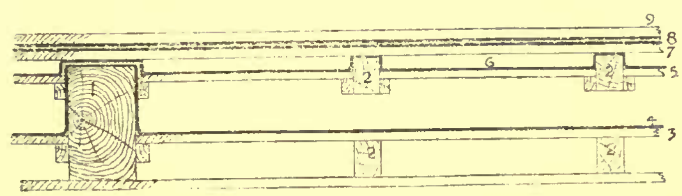
For these reasons I thought the following construction would be preferable: (1) A common grooved-and-tongued flooring between the joists, as before; (2) one thickness of felt laid on over the joists and passing over the top and all around said joists so that no wood from the upper floors shall touch the joists; (3) grooved-and-tongued floor as before; (4) one thickness of felt; (5) scantlings one-inch and two-inches, and (6) the finished flooring. In this case both floors are running in the ordinary way.



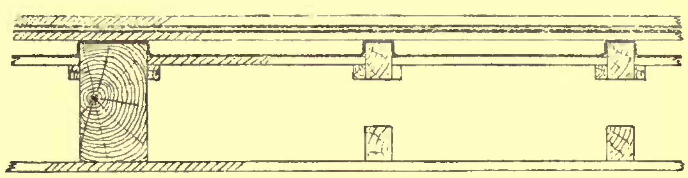


It is a general practice here, to fill the empty spaces between outside wooden partitions with sawdust. Some find that a very good idea and others don't. (I don't.) It is evident that the purpose is to cut off rain, snow, cold, etc., but I don't think it does that effectively, for several reasons, which would be too long to be enumerated here; and besides, I find to that practice a great inconvenience outside of the danger from fires; that is, if some water introduces itself in the sawdust it will make it rot and the body of the carpentry with it. I tried another device and I wish to get your opinion of it.

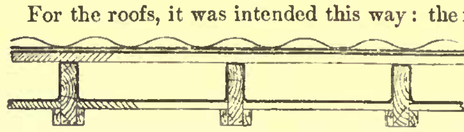
For the clerestory wall (wooden partition) there is: (1) the main posts which carry the roof; (2) outside and inside partitions in 4″ x 3″ scantlings, 2′ 4″ centres; (3) a grooved and tongued board-

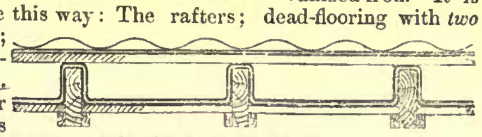


ing with one thickness of felt passing over main posts; (4–5) another boarding with another felt; (6) the roof-boarding; (7) two felts; (8–9) the slate. The other way was as this figure, which is the best.



For the roofs, it was intended this way: the rafters, dead flooring with *one* felt and sawdust; the roof-boarding; two felts and slate or galvanized-iron. It is intended to be done this way: The rafters; dead-flooring with *two* felts; roof-boarding; two felts; galvanized-iron or slate. In giving an answer to these questions you would greatly oblige your obedient servant,





JOS. VENNE.

[AN unusual piece of carelessness on our part in forgetting to have the cuts prepared, has delayed the publication of this letter and our answer. We do not much approve any of the ways suggested for deafening the floor. The first plan, of cutting-in tongued-and-grooved boards between the floors, laying mortar on top of this, and then a double flooring with tarred felt between, would, with a plastered ceiling underneath, be very likely to cause the beams to rot, as our correspondent suggests. This could be improved by leaving out the tarred felt, and substituting cinders for the ashes. It is common in New York, where this material is in great request for filling in under the wood flooring of fire-proof buildings, to use locomotive cinders, which have the fine, ashy-part all blown away by the steam blast of the forced draught, and allow a certain circulation of air through them. In the present case, the floor would be much lighter, and tolerably good, with the mortar alone.

Another way to apply the deafening mortar is to lay one-inch strips on the under floor for grounds, and cover the whole with mortar, and, after this

is dry, take up the strips and fill with fresh mortar the places which they have occupied. The upper floor is then laid on the mortar and the nails driven through it. This would be simpler than the second way that our correspondent proposes, to lay tarred felt over the beams, resting on boards cut in between them, and put a second layer between the upper and under flooring, and it would be free from the disagreeable smell of tar which would hang for a long time about a floor with so much felt in it, to say nothing of its superior fire-resisting qualities. The batting interposed between the upper and under flooring, over the felt, would have little advantage.

As to the use of sawdust for filling partitions, we quite agree with our correspondent, having found it liable to settle greatly in the partitions, so as to leave the upper portion empty after a time, while if it gets wet, it is apt to become very troublesome. For these reasons the repeated layers of boarding and felt proposed have a certain advantage, but we should much prefer, instead of using them, to cover the roof, and the clerestory partitions, with three-inch plank, grooved, and with a hard-wood tongue inserted, boarding and slating outside of this. — Eds. American Architect.]

PROPORTIONING VERTICAL BOILERS.

Newark, N. J., February 10, 1887.

To the Editors of the American Architect: —

Dear Sirs,— Will you kindly let me know, through the *American Architect*, or by mail, a safe rule for proportioning vertical boilers for steam heating. I have several books on the subject, but the rules are for horizontal boilers, and do not agree with the proportions of vertical boilers made by boiler-makers. Is there a book on the subject that you can recommend if it is not convenient for you to give rule? Yours respectfully, Steam.

[We do not know of any rule for proportioning vertical boilers by heating surface, as is done for horizontal boilers, but it is usually considered that a given surface of vertical tubing has only about half the efficiency, in heating water around it, of a similar tube placed horizontally. Much depends also upon the design of the boiler itself, many vertical boilers being intended rather to be convenient self-feeders than very efficient heaters. By far, the best book on the subject that we know is Baldwin's "*Steam Heating for Buildings*," which gives a good deal of information in regard to vertical boilers. — Eds. American Architect.]

NOTES AND CLIPPINGS

Cost of the National Capitol. — An interesting statement showing the cost of the Capitol has been prepared, the reading of which probably will cause Holman some additional pangs of grief and vexation. From this statement it appears that down to the time of its destruction by the British, in 1814, the Capitol building had cost $787,168. The items for rebuilding and additions have been as follows: Cost of old wing and central building, $1,614,240; new wings, $8,805,332; new dome, $926,290; repairs and improvements, $968,224; water from Smith's spring, $55,945; additional land, $971,883; improving ground, $1,596,725; marble terrace, $200,003 — making a total of $15,925,810.— *N. Y. Tribune.*

The Lowe Incandescent Gas-light.— The Lowe incandescent gas-light was recently exhibited by the Lowe Manufacturing Company, of Norristown, Pa., U. S., at the "Novelties" Exhibition of the Franklin Institute. It is produced by allowing non-luminous water-gas to impinge on a spiral wire of platinum-iridium or platinum. Several forms of the burner are used. Those shown at the exhibition and examined by the judges were formed of a stout wire of horseshoe shape, the ends of which were attached to a brass collar, and snugly fitted on the ordinary lava-tipped slit burner. On this stout wire was tied, by means of a fine wire of the same material, a close spiral of the platinum or platinum-iridium, the stout supporting wire being placed on the upper or outer surface of the curve formed by the spiral. The size of the horseshoe varies with the size of the burner on which it is intended to be used. They were shown singly or in groups or clusters upon chandeliers of the ordinary pattern, and in tastefully-decorated rooms. The adjustment of the spiral is such that every part of it may be equally heated. For this the alignment of the spiral with regard to the flame must be perfect, and the orifice from which the flame issues must be kept free from dust, otherwise the unequal brightness of the spiral becomes at once apparent. The Lowe Manufacturing Company claim to have had 2,000 hours of service from experimental burners of this type, without appreciable deterioration. The jury, from tests made, arrived at the conclusion that for the Lowe incandescent light to compete with the ordinary illuminating gas it will have to be supplied with gas at two-fifths the cost of illuminating gas. Whether this can be done or not the jury refrain from expressing an opinion, but they have awarded a silver medal to the Lowe Manufacturing Company. They were favorably impressed with Mr. Lowe's production of water-gas as a fuel for cooking, baking, heating, and so on, in restaurants and houses. The water-gas is made by the interaction of steam and carbon at a high temperature, and is composed essentially of hydrogen and carbonic oxide.— *Engineering.*

TRADE SURVEYS

The natural outcome of six months' rather unusual activity in railroad-building and in general manufacturing is the investment of money in real estate and in lands, mineral properties, and in other forms of wealth which are likely to increase in value through the steady growth of population throughout the country. Real-estate operators in many of the larger cities, and, in fact, in many small towns throughout the country, have spoken frequently of late of an improving demand for building-lots and manufacturing-sites, as well as for properties for suburban building purposes. It is more than the ordinary and natural increase in activity that we refer to. Extensive purchases are being made of lots, sites, farms, and regions of country. The growth of population will force a demand for a great deal of property within the next five or ten years. The real-estate value of the entire country is growing, rather, it is taking a leap; and it is the observation of this fact that is at the bottom of most of the large operations to which reference is intended. Railway-building has led the way. Extensive purchases have been made in Kentuckey, Tennessee, Alabama, and even in Texas and Old and New Mexico. The purchasers of land are carefully studying the prospective requirements of the people, and in many cases have purchased in entirely new sections of the country, far away from present railroad lines. This movement is destined to grow in strength, and is fraught with considerable importance to the people. Desirable or eligible properties cannot be purchased in the next few years at the prices at which they are now offered. In spite of Henry George's theories "the unearned increment will be added to present values." And buyers of property, large or small, will find land everywhere dearer outside of the limited government reservations. Several syndicates have been formed during the past few months for the purpose of making money in this way. One of them has purchased 50,000 acres of coal-land in Western Pennsylvania; another, it is reported, has purchased 30,000 acres of mineral and timber land in Virginia; and syndicates by the dozen are buying up and controlling oil and natural-gas fuel territory in half a dozen States. Another combination has just been formed to practically control the production of bituminous coal in four States, and another combination is seeking to take a fresh lease of life for one year in order to control the price and distribution of 35,000,000 tons of coal. Other combinations are forming to control, or dictate against, the natural law of supply and demand. Trade combinations of one kind or another continue to spring up for the purpose of protecting the interests controlled from the legitimate effects of unrestrained competition. All these combinations in reality amount to but little. We have seen prices advance without a resistance, and have seen prices decline against organized protests. There is something beneath the surface of trade which is as strong and immutable as the laws of the Medes and Persians, and which no combination can permanently deflect from its natural course. At the same time it is well for the wealth-producing interests to keep these great influences and agencies constantly in sight. The best interests of the public at large will triumph in the end. What the natural laws of trade cannot accomplish will be nicely supplemented by legislation which an enlightened public sentiment will command. The passage of an Inter-State Commerce bill illustrates the power and significance of this sentiment. The proposition to enact laws of a more radically self-protective character against corporate might and greed is welcomed by the general public with a far different expression than would have been made ten or twenty years ago. The general public understand questions which so long ago were dark to them; and the managers of our great industries now see possibilities for development which they did not then understand. In manufacturing-circles there is nothing whatever to discourage those who have laid out plans for the investments of large sums of money. More mechanical power is urgently needed, and the demands for it are seen in nearly every industry. The result of the activity in railway-construction last year has led to the placing of orders for locomotives by a great many railroad companies, amounting so far this year to over 300. Railway-managers on the trunk lines, and on many Western lines, as well as on some of the roads to be railed this season, will place orders for between 400 and 500 engines before midsummer. These seem like exaggerated figures, but a computation of the orders contemplated by the railroad companies of the country will show that they are within the limit. Railway-managers are also preparing to place extensive orders for freight and coal cars that will completely absorb the capacity of every car-works in the country. While there is a slight reaction this week in prices, the general sentiment is that the elements of expansion are in favor of higher prices before the present period of activity has reached its fullest limit. Throughout the West, every machine-shop is loaded-up with orders. Taking shop-capacity of all kinds, all over the country, we find it oversold. Coming close to our own home, we find job-printers working frequently to midnight. Book-makers have more work in hand than they have had for years. The hardware-establishments in the New England States are running full time to fill spring and summer orders. The makers of wood-working machinery have, during the past six weeks, booked a fresh batch of orders that will guarantee them against slack times for three months. The iron and steel makers are more overcrowded than any other line of industry, and rail-makers have been bold enough to advance prices $1 within a week. Foreign material will shortly decline, and importations on this account will largely increase. Last year's iron, steel, and ore importations exceeded 2,000,000 tons, and the contemplated importations this year will increase these figures by 25 per cent at least. At the same time a great deal of business is done at very little margin; and with all the apparent prosperity and excellent prospects, business men and manufacturers are being ground into close quarters, but not to death, between the upper and nether mill-stones of competition. The country is galloping into a dangerous activity, but there is a policy to be pursued which will maintain active markets for everything that can be supplied. The fact that 10,000 failures are reported annually under the existing favorable trade conditions is a good sign rather than a bad one, because it shows that the margin of profits is so light that none but the best-equipped business capacities can endure the desperate struggle that is maintained in the modernized warfare of trade. The labor problem will be less annoying this year than last. There are several reasons for this prediction. The best one is, that the leaders among the organized laborers recognize the fact that most of their strikes have been miserable failures; that capital and employers are better organized than last year, that there are fewer grievances to adjust and less opportunity of adjusting them through the medium of strikes. Then again, the trades-unions leaders recognize that their reputations are at stake, and that they cannot afford to bring many more defeats upon their followers. The managers of great industrial establishments and of large corporate interests have shown themselves able to resist strong combinations, either right or wrong. The coal-handlers' difficulty is a case in point, and which has been a valuable lesson to both sides. One effect of these labor agitations is to demonstrate that the workingmen have a feeling akin to patriotism; and employers recognize that it is possible to arouse the workingmen, or the bulk of them, in a half dozen States in a just strike. Yet it is not probable that industry will be jeopardized from this cause. With strong labor organization there is a strong conservative feeling developed. The building-trades, both masters and men, have been organized in a dozen cities, and there is a cohesiveness on each side which will create and maintain mutual respect. A number of difficulties have been adjusted within the past month in the building-trades in several cities without the slightest jar, and terms are being quietly made, which point to the maintenance of friendly relations throughout the year.

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PHOTO-GRAVURE CO., N. Y.

THE FIRST PARISH CHURCH AND SOLDIERS' MONUMENT,

MEETING-HOUSE HILL, DORCHESTER, MASS.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, TICKNOR & COMPANY, Boston, Mass. No. 583.

FEBRUARY 26, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

THE *Investigator*, one of the oldest and best insurance journals, publishes an editorial warning underwriters against insuring churches. Although it acknowledges that the "moral hazard," by which underwriters mean the probability that a building will be set on fire to get the insurance-money, hardly exists at all in connection with churches, "the fact remains," as it says, "that churches are among the worst risks in the business," and it advises its readers to let them alone. The reasons which it gives for the existence of a particularly combustible disposition among church buildings are rather amusing, not only as involving a well-deserved criticism of the methods too often employed in church construction, but as expressing, quite unconsciously, the indulgent contempt which a business man is rather apt to feel for church management. As the average loss for each church burned is something over nine thousand dollars, it is evident that the more costly structures are quite as subject to fires as the cheap ones; and the *Investigator* finds the principal reason for this to consist in the anxiety of the builders of churches "to make the extreme limit of external show," securing their end by means of "lath and plaster shams" in place of solid work. To the hazard of cheap and false construction is, moreover, usually added a still worse one, in the shape of a tower, or spire, "to catch and hold any sparks that are in the neighborhood at heights beyond the reach of the ordinary fire-extinguishing facilities;" and the whole inflammable structure is kept in jeopardy by the special qualities of the heating-apparatus generally placed in it. This heating-apparatus is commonly made very large, "so as to give out a great quantity of heat in a short time," and, when put in action, it is required to warm, in a few hours, to a comfortable point, a large building, almost always thinly and poorly constructed, which has been left cold for nearly a week. The person who takes care of the church fires, and who, as the *Investigator* uncharitably says, "is usually some one who has not had enough gumption to make his living in the ordinary vocations of life," crowds the furnaces to their utmost capacity; the flues and pipes, after having been kept a week at a temperature not far removed from freezing, are violently expanded, and the weaker points yield, finally forming a crack, through which comes, sooner or later, a fatal spark.

THE *Wiener Bauindustrie-Zeitung* quotes at length a set of rules for the construction of stoves, and for kindling and maintaining fires, which have recently been published by the Town Council of Dresden, for distribution among the citizens. Most German, Swiss and Dutch houses are warmed in winter by means of stoves, which are sometimes of small size, for heating single rooms, sometimes large enough to heat two rooms, between which they are placed, but in either case are usually built of brick, or of enamelled tiles. In many instances, particularly in hotels, the stove is placed at the intersection of the partition between two rooms with the wall of a corridor or hall, in such a way that the servants can feed and attend to it from the hall, while it distributes its heat between the two rooms. For such purposes the affair must be of considerable size, and, as the flues in German chimneys are almost always very small, four inches by eight, for instance, being a common size, it is important that the fire should burn evenly and well; and the Dresden rules are the product of a good deal of observation of stoves in which this end is not attained.

THE most important rule in arranging the dimensions of the stove or furnace is to have the grate smaller in diameter than either the ash-pit or the fire-pot, both of which should expand, like an hour-glass, away from the grate. The grate itself is required to have bars so near together that the coal to be used will not fall between them, but no further directions are given in regard to it; and it would seem that our familiar anti-clinker grates, which can be shaken or rocked from the outside, without allowing ashes to escape into the room, must be unknown in Germany. The front portion of the grate, according to the rules, is to be occupied by a plate of iron or fire-clay, sloping upward from the grate to the bottom of the fire-door, in the same way as the "dead plate" occasionally used here in setting boilers; and, finally, the doors, both of the fire-pot and the ash-pit, are required to shut close, and to have registers for controlling the admission of air through them.

BEFORE kindling a fire in the stove so constructed, all remains of previous fires, according to the rules, must be cleaned away, leaving the grate clean. Fresh coal, dry and free from dirt, is then to be piled up at the back of the grate, occupying about two-thirds of its area, and in front of this is to be placed kindling-wood, mixed with small lumps of coal. The wood is then to be lighted, and the upper door closed, leaving the ash-pit door wide open. At this stage of the proceeding it is important to keep the kindling-wood in active combustion, in order that heat enough may be developed to ignite the coal; and the opening of the upper door, either to see how the fire is getting on, or with the idea of admitting more air, checks the burning of the wood as well as the draught of the chimney, and cools off the fire-pot, which, when heated by radiation from the blazing wood, aids greatly in raising the temperature of the coal. If, in spite of these precautions, the kindlings should partially fail of their effect, and burn nearly out before inflaming the coal, the lower door must be cautiously shut, so as to cut off a part of the supply of air, which is now too great for the combustion to be supported by it, and cools and deadens the feeble fire; and by careful nursing in this way it may be possible to revive an almost expiring flame, and encourage it into the activity desired. In either case, after the heap of coal at the back of the grate has become well kindled, it should be drawn forward with a poker or slice-bar, and spread evenly over the grate. The fire is then to be watched through the ash-pit. So long as the fire radiates a red light through the grate, uniformly over the bottom of the ash-pit, all is going well: but a shadow, or the eclipse of a portion of the shining area of the grate, shows the presence of some obstruction to the draught, which should be promptly removed, by opening the upper door, and raking the fire, shaking down through the grate the ashes which may have caused the eclipse; or pulling out clinkers with poker and tongs, or breaking up the lumps which often form by the melting of bituminous coal, and which can sometimes be avoided by mixing coal of this sort with coke or coal of a harder kind.

IN all cases the ash-pit must be watched, to see that it does not get too full of ashes. The rule is, that as soon as it is half full, it should be cleared out; and any accumulation beyond this point checks the fire, by cutting off the access of air, while it endangers the grate itself, which, no longer cooled by the free passage of air through it, and exposed to the reverberation of the hot ashes close below, often melts so much as to lose its shape, even if it is not entirely destroyed. If the fire gets low, and it is desired to revive it, fresh coal should never be thrown directly upon the remains of the old fire. If

the slackening of the combustion has been caused, as will often be the case where the attendance has been remiss or not intelligent, by an accumulation of ashes or clinkers, cutting off the air-supply, the addition of fresh coal will add to the evil, by producing an irregular, smoky and wasteful fire, which tends to melt the ashes or clinkers already present, increasing the trouble which they cause, and often incrusting the grate or the fire-pot lining with a hard mass, which it is almost impossible to remove; while, if the fire has been kept clear, but has burned low for lack of fuel, the addition of cold, fresh coal abstracts so much of the small store of heat which still remains as often to put the fire out altogether. Instead, therefore, of putting the new coal on top of the old, the smouldering fire should be cleared of ashes, and the live coal pushed back to the rear portion of the grate, leaving the front portion, for about one-third of its area, entirely free. The fresh coal is then to be placed on this part of the grate, and on the sloping dead-plate, and the upper door closed. As the pieces of coal nearest the fire become heated and decompose, the gases which they evolve pass over the live coals on their way to the flue, and their ignition begins immediately to warm the fire-pot and kindle the rest of the fuel, and when the whole has begun to burn, it is only necessary to spread it uniformly over the grate. Much of this good advice is with us applicable to the care of boiler furnaces, rather than house stoves, which our manufacturers make either self-feeding or in some other way so automatic as to need little care or attention; but the principles laid down are excellent, and we might, perhaps, afford, in gratitude for instructions which, if followed, would save owners of steam-boilers many dollars, to send back in exchange to Germany a few samples of those strong and convenient cast-iron stoves which our foundries make so cheaply and so well.

ALL accounts show that a revival of business is taking place all over the world, and unless some great war comes to destroy property and disturb commercial relations, the next year seems likely to be a pleasant one for all those who make their money by the prosperity of other people, and not by their misfortunes. The price of iron, which, as an index to activity in construction, is usually regarded as the barometer of business prosperity, has risen everywhere. In England, as we learn from *Le Génie Civil*, pig-iron has advanced nine shillings a ton, or about thirty per cent, and even at this advance a single order of ten thousand tons has been sent to Middlesbrough from a foundry in St. Louis, which finds it better to buy English iron, bring it by sea from Middlesbrough to New Orleans, pay a heavy duty upon it, and then have it transferred to river-boats for transportation to St. Louis, than to use American iron, the cost of which, delivered at the foundry, would be only five or six per cent less than that of the foreign material. In Belgium, which has of late years been deeply sunk in labor troubles and business depression, iron, as well as the coal needed for working it, have risen materially. Even at present prices, however, it is rather tantalizing to see iron I-beams, which we do not consider dear here at three cents a pound, quoted at Charleroi at one cent; while rails, the price of which in Europe is not very different from that of rolled beams, can be had here for about half as much as is charged for the material of construction which it is so desirable to bring into extensive use. In Germany, thanks to extensive orders from Brazil and the Argentine Republic, as well as from the United States, the rolling-mills and foundries are in active operation, and prices have risen in proportion to the increased demand.

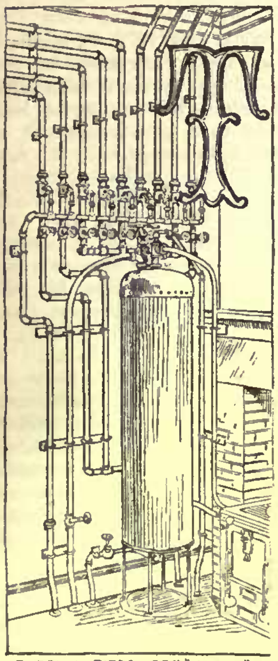
WE regret very much to learn from the *Building World* that Mr. Jonathan Carr, the founder of the famous suburban village of Bedford Park, near London, has fallen into financial misfortune, with, however, a possibility, which we trust may improve into a certainty, of being able to meet his pressing liabilities, and to save a small remnant out of the great property which he once held. In many respects, Mr. Carr is one of the best and most favorably known men in England. If we are not mistaken, he is a brother of Mr. Comyn Carr, a distinguished critic, and, although engaged in important business affairs, has always taken special pleasure in associating himself with that artistic movement which seems likely to do so much for England. Some fifteen years ago, a large estate in the vicinity of London, which had originally been the park attached to one of the castles of the Dukes of Bedford, was put in the market, and Mr. Carr, who was then a very rich man, appreciating the advantages which would result from keeping it under one control, and laying it out and building upon it in accordance with a scheme devised to preserve as far as possible its natural beauty, took the resolution of buying the whole estate. Having made this acquisition, he employed the best landscape gardeners to lay it out for building upon it, and applied to Mr. Norman Shaw, Mr. Edis, Mr. E. W. Godwin, and one or two more of the English architects best known for their success in domestic architecture of the picturesque sort, to design for him a variety of dwelling-houses, modest in dimensions, but full of distinction and artistic style, and so grouped as to retain so far as possible the natural beauty of the old park. The labors of the architects were seconded by Mr. William Morris, who decorated the houses with those matchless furnishings which have made his name famous all over the world, and tenants and purchasers were then invited to choose among them. The deeds and leases contained restrictions as to the occupancy of the houses, intended to secure perpetual immunity from the annoyances of manufacturing or mercantile business in the neighborhood of the village, and lots were set apart, upon which were constructed a church, and a club-house containing reading and reception rooms, for the use of the residents and their families. It was not long before the advantages of living in such a neighborhood began to be appreciated, and hundreds of people applied for the privilege of enrolling themselves among the inhabitants of Bedford Park. Mr. Carr himself built a beautiful house in the midst, and it seemed certain that he would reap a large profit from his undertaking, at the same time that he gave pleasure to a great many people of cultivated taste. What may have been the circumstances which led him into loss instead of profit we cannot say, this part of the history of Bedford Park not having yet been made public; but early in the winter the originator of the whole scheme was petitioned against in the bankruptcy court, by creditors exhibiting claims to the amount of seven hundred and fifty thousand dollars. Most of the creditors were secured by mortgages on houses and other parcels of real estate; and at the time referred to in the *Building World's* account it was hoped that the rents would keep the interest on the secured debts paid, leaving enough surplus to meet the unsecured obligations, and finally, to pay off everything in full.

ANOTHER grief has been added to the woes of the lovers of picturesque nature by the announcement that a concession has been granted for the construction of a railway from Visp to Zermatt, where now only a bridle-path, and that not a very good one, serves for communication. Zermatt, as every one knows, is the favorite starting-point for those people who like to risk their lives on the Matterhorn and Monte Rosa, and consists of a small, cold valley, five thousand feet above the sea, surrounded by mountains covered with snow and ice. Notwithstanding its chilliness, and the difficulty of getting to it, Zermattis visited by about twelve thousand persons every summer; and it is calculated that if this number should be increased to fifteen thousand, by the improved facilities which the railroad would give, that the enterprise would bring a good interest on its cost. Like most of the mountain railways now under way in Switzerland, the Visp-Zermatt line is to be of narrow guage, with a third toothed-rail in the steepest section, where the grade is one hundred and fifty feet in one thousand. The concession limits the time within which the road must be completed to two years and a half from the time that the engineer's plans are accepted, and fixes also the price of transportation, which is to be sixteen francs from Visp to Zermatt, for first-class passengers, and ten francs for second-class. Near by is to be built another mountain road, for which the plans are now under consideration, extending from Brieg, by the Rhone glacier, to Airolo, at the south end of the St. Gothard tunnel, bringing into direct communication the Italian railway system, and the great Swiss and German system, which centres at Lucerne, with the roads of southeastern Switzerland and southern and central France.

A CORRESPONDENT of the *Deutsche Bauzeitung* corrects the prevalent idea that the chimney of the Mechernich lead-works is the highest in the world. Although this is higher than the chimney of the St. Rollox Chemical-Works at Glasgow, it is considerably surpassed by another in Glasgow, that of the Port Dundas Chemical-Works, which rises to the height of four hundred and fifty-four feet above the ground.

THE WATER-SUPPLY OF BUILDINGS.[1] — II.

GENERAL ARRANGEMENT OF THE PIPING.



SUPPLY PIPES SET "OPEN"

THE entire system of supply-piping should be exposed to full view. Nothing should be inaccessibly encased behind panelling, or buried beneath floor boards or plastering. Well executed and brightly polished and lacquered piping may always be made ornamental. In the principal rooms and main hall, hinged and panelled doors may be used in front of the pipes if necessary, and the exercise of a little taste and ingenuity on the part of the architect will render these ornamental features in the design. As a rule, however, it will be found possible to avoid carrying the pipes through these rooms.

Although there is really no sound practical objection to this entire exposure of the piping throughout a house, it is nevertheless very seldom carried out, and the careful owner is obliged to apply to the architect for a "piping-plan" for reference, in case of repairs. This plan is, however, usually so carefully stowed away by its anxious guardian, that he is seldom able to lay hands upon it again, after the lapse of years, when it is needed, and a widespread devastation of the floors and plaster by the ruthless plumber is the result.

For the purpose of avoiding the possibility of such a loss, it has been lately recommended to have the plan painted in oil color on the inner panels of some convenient closet door. Others again advise painting lines of color, indicative of the various kinds of pipes, red for hot-water and blue for cold, on the upper floors over the pipes themselves. Either of these methods of indication would indeed ensure the owner against misplacement; but no map yet devised could point out a leak, or facilitate the execution of a repair on buried piping.

All trouble would be avoided and better work obtained by having the pipes themselves form their own plan. Equally important with an open-setting of the pipes, is their arrangement in such a manner that they shall thoroughly drain themselves when the supply is shut off, so that when the building is to be left unoccupied for any length of time, there may be no danger of accident from freezing.

All horizontal lines of soft-metal pipes, moreover, should have a *continuous* support, since otherwise they will sag under the influence of expansion and contraction, and form a series of running traps. Expansion will evidently cause a bagging between the supports. Subsequent contraction cannot restore the pipe to its former position, because the weight of the material overcomes the cohesion of its particles, and it is easier for it to stretch than to lift its sagged portion back into line. This is forcibly illustrated by the creeping of lead sheets used in roof-



Fig. 1.

ing. Figure 1 gives an illustration of the condition of a pipe subjected to alternating temperatures after several years of use. Such a pipe could never be drained, and would burst if exposed to frost. Instead of the tacks, a continuous strip of wood should be used for support.

When a house is closed, or left for the winter, it is not sufficient merely to shut off the main street supply at the cellar wall, but the entire pipe system must be completely drained. This will be extremely easy if the work has been properly executed, but impossible if it has not. The rising main may be emptied either through a special draw-off faucet, or through the small waste-hole of the main stop-and-waste cock. All branches should drain back into the main supply. Otherwise it will be necessary to turn open their faucets.

The down-pipes from the main tank should then be emptied by opening the lowest faucets; the tank itself, by means of its large blow-off pipe, and not through the descending service-pipes, to avoid choking them with sediment.

Another important general principle is that all pipes should, as far as possible, be protected from frost. Exposed corners, outer walls, and places which cannot readily be heated in winter, should be avoided. Where, however, it becomes necessary to run them along an outer or exposed wall, the pipes should not be placed directly in contact with such wall, but should be fitted on small strips or shelves of wood nailed to the masonry, or even packed with some non-absorbent, non-combustible material, such as felt, asbestos, or mineral wool. Pipes are much less likely, as a general rule, to suffer from frost, when they are set open and accessible to the warm air circulating about the house, than when they are concealed behind the furring or between the joists, against the cold walls and interspaces of the framing. A proper placing and protection of pipes from frost is probably the best preventive of water-waste. The pernicious habit of leaving water running during the night, and in "cold snaps" of weather even during the daytime, would be much less common if proper precautions were taken in setting; and no better means of protecting the public against this selfish wastefulness could be devised in unmetered houses, than to require the pipes to be set open, and where they pass through cold places to be jacketed. The expense to the owner of thorough jacketing would ensure the proper running of the pipes in the warmest places. Mr. James C. Bayles says in his "*House Drainage and Water Service*": "During, and immediately after a 'cold snap' in January or February, our streets present a curious appearance. At frequent intervals we see groups of laborers tearing up the pavement, or building bonfires to thaw the ground enough to permit them to expose the buried pipes. During the winter of 1874 I saw as many as a dozen such groups on one block in the upper part of New York, and while the effect upon the eye was picturesque, the effect upon those compelled to pay over and over again for the same work, which never should have been necessary in the first instance, was not all that could be desired. Probably we shall see the same thing every cold winter, for years to come, and while the public misfortune will bring profit to the plumbers, it will not benefit the trade in the long run. . . . The inconvenience suffered, great as it may be, is of small consequence compared to the danger of sewer-gas poisoning, especially in the absence of adequate soil-pipe ventilation, and the nuisance resulting from the accumulation of foul matter in water-closets."

THE MAIN HOUSE-TANK AND ITS PIPING.

Mr. Bayles also rightly says: "To so arrange the service-pipe system in a house that, so long as the average pressure is maintained in the street mains, or main supply-pipe, we shall have a constant flow, if desired, at any and every cock and closet valve, is one of the refinements of the plumber's art, which does not come within the knowledge of a majority of those who claim to know their trades. Certainly it is a desideratum for which comparatively few architects know how to provide without adding greatly to the cost of the plumbing work in a house."

It is therefore important both that our system of piping should be reduced to the utmost possible simplicity, consistent with convenience and safety, and that its philosophy should be explained in the simplest manner.

Beginning with the house-tank and its piping, the following rules are always to be observed as of vital importance.

(1) Excepting under peculiar conditions, hereafter to be considered, the drinking and cooking water should be drawn from the main supply-pipe leading to the tank.

(2) All water used for water-closet flushing and for lavatories and boiler-supply, should be taken from the tank or its down-pipe.

(3) The pipes should be so graded in size as to give a constant supply at every story to which the pressure would raise it, irrespective of what is drawn in stories below.

(4) The main tank should be placed at the highest point in the building, at which a sufficient daily supply of water can be assured.

(5) All water-closets below the main house-tank should be supplied immediately from it. All above the main tank should be supplied from special cisterns of their own.

The water is brought to city houses from the street-main, through a pipe whose size is limited by the water companies. We will assume it to be five-eighths of an inch in diameter, for

[1] Continued from page 40, No. 578.

our present illustration. At the end of this pipe, just within the cellar wall, should be provided a stop-and-waste cock. From this point it should be enlarged considerably, for the purpose of avoiding friction, since, with a given size of pipe at the cellar wall, a much larger quantity of water can evidently be obtained in a house in a given time through a large than through a small system of piping.

We will start, then, with an enlargement to one and one-half or one and one-fourth inches, according to the number of fixtures in the house to be supplied, and carry the pipe of this size through the cellar and basement, and up to the top of the kitchen boiler. All branches taken from this run of pipe to the various kitchen and laundry lavatories will be from one-half inch to one inch in diameter, according to the number and kind of fixtures to be supplied. Where iron supply-pipe is used special sizes will be given for this material hereafter.

From the boiler, the diameter of our main should be reduced, say a quarter of an inch, or to one and one-quarter inches or one inch again, according to the number of fixtures to be supplied; and it should continue of this size, up through one or two stories, as may be required, the branches ranging from one inch to one-half inch as before.

A further reduction should be made as the main ascends, until it reaches the tank, where it need not exceed one-half or five-eighths of an inch in diameter. In short, this pipe system should be constructed on the principle of the trunk and branches of a tree which has to supply sap to its leaves and blossoms. At every branch or twig a diminution of size occurs in proportion to its bulk, and each leaf and blossom obtains its full supply of nourishment at all times, independently of the rest.

The distribution of hot-water may be similarly planned, as will be described under the heading of "Hot-Water Circulation." This method of piping is little or no more expensive than the usual one.

To carry out our second rule, we pursue the same system; All the water-closets in the house should be supplied directly from the down-pipe from the main tank, without the intervention of special cisterns. There is no advantage in complicating the work by the use of these small cisterns, with all their paraphernalia. By doing away with them, we save, in the first place, the cost and chance of leakage of each cistern ball-cock, of the cistern itself, with its valve mechanism, brackets, etc., and of the supply and overflow pipes from cistern to water-closet; and, secondly, we would save the expensive wooden cistern casing, and the space in the room occupied by it and its fittings. We should avoid, also, the disagreeable noise of the water entering the cistern from its ball-cock, and the open bodies of water standing in the cisterns, which, by evaporation, create a dampness in the house, often very undesirable.

The improved modern water-closet requires, for proper flushing, a rapid water-supply. Hence the down-pipe from the tank should be large enough to furnish the volume of water required very quickly, and a pipe two inches in diameter will not be too large at the top. It may diminish as it descends to the basement, and as the lateral branches are taken off. The size of the branches should be regulated by the distance of each closet from the down pipe, as well as by the water-head in each story, and should vary between two inches and one inch, according to circumstances, and, for the sake of economy, the down-pipe should be made of iron properly protected from rust.

Each water-closet should have under its seat a simple valve, at the end of the branch-pipe, for flushing.

The reason why this economical system of water-closet supply has not heretofore been generally adopted, is because of the difficulty of constructing a cheap and reliable valve, which should deliver quickly a suitable volume of water, under the highest as well as the lowest pressure involved, and which should close automatically, without noise or concussion.

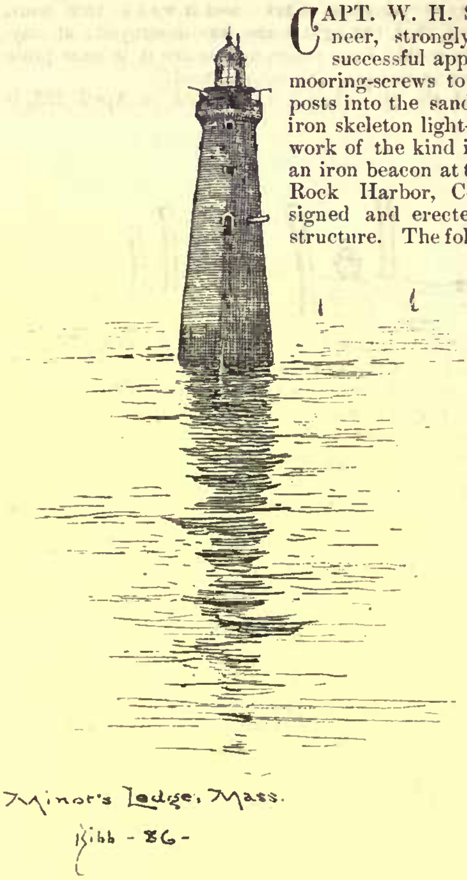
J. P. Putnam.

[To be continued.]

Education in Art in St. Louis. — An odd incident shows that education in art is still needed in St. Louis. The great library of that city is preparing for removal, and a sale of pictures took place. At the sale a bronze reproduction of the Venus of Milo, which cost $1,700, was sold as a "fixture" for $5, by one of the directors, whose art education had possibly been less thorough than his business training. Fortunately, the librarian rescued the Venus before the sale was completed.— *Boston Journal.*

ANCIENT AND MODERN LIGHT-HOUSES.[1] — IX.

MINOT'S LEDGE LIGHT-HOUSE.



Capt. W. H. Swift, U. S. Engineer, strongly impressed by the successful application of Mitchell's mooring-screws to the forcing of iron posts into the sand as a framework to iron skeleton light-houses, built the first work of the kind in the United States: an iron beacon at the entrance of Black Rock Harbor, Conn. He then designed and erected a more important structure. The following account is taken from his official report (November, 1848).

"'Minot's Rocks — or as they are more generally called 'The Minots,' — lie off the south-eastern chop of Boston Bay. These rocks or ledges, with others in their immediate vicinity, are also known as the 'Cohasset Rocks,' and have been the terror of mariners for a long period of years; they have been, probably, the cause of a greater number of wrecks than any other ledges or reefs upon the coast, lying as they do at the very entrance to the second city of the United States in point of tonnage, and consequently where vessels are constantly passing and repassing. The Minots are bare only at three-quarters ebb, and vessels bound in with the wind heavy at north-east, are liable, if they fall to the leeward of Boston light, to be driven upon these reefs. The rock selected for the site of the light-house is called the 'Outer Minot,' and is the most seaward of the group. At extreme low water an area of about thirty feet in diameter is exposed, and the highest point in the rock is about three feet and a half above the line of low water. It is very rarely, however, that a surface greater than twenty-five feet in diameter is left bare by the sea. The rock is granite, with vertical seams of trap rising through it. The form of the light-house is an octagon, twenty-five feet in diameter at the base. The structure is supported on nine heavy wrought-iron piles, one at each corner of the octagon, and one at the centre; holes twelve inches in diameter, and five feet deep were drilled in the rock to receive these piles; the outer holes at such an inclination that at an elevation of sixty feet above the base of the middle pile, the pile-heads would be brought within the periphery of a circle fourteen feet in diameter. The centre pile was eight inches in diameter at the bottom, and six inches at top; the other piles have the same diameter, eight inches, at the bottom, and four-and-a-half inches at the top; at their upper ends they are securely keyed and bolted to the arms of a heavy casting or cap. It is understood that the foundation piles do not extend the whole sixty feet; but that there are in all three series of piles joined to each other by very stout cast-iron sockets and strongly braced."

In that exposed situation, where the sea was so constantly breaking over the rock, the drilling of holes of the required size could only be done by machinery raised above the reach of the sea. This operation consumed the greater part of two seasons. The erection of the tower was less difficult. The work commenced in 1847, was finished in November, 1848. Next year, in order to stiffen the piles, and to prevent in as great a degree as possible the tendency to vibration, there was introduced a series of wrought-iron vertical tie-rods between the first and second series of braces. It was intended to place another series of these ties between the foot of the piles at the rocks, and the first or lower series of horizontal braces. This structure was carried away in April, 1851. Captain Swift reported as follows: "On Monday night, April 14, the wind, which had been easterly for several days, gradually increased. On Tuesday it had become a severe gale from the northeast. It continued to blow with the utmost violence through Tuesday night, Wednesday, Thursday, and even Friday; but the height of the storm was on Wednesday, the 16th, and at that time it was a perfect hurricane.

"The light on the Minot was last seen from Cohasset, on Wednesday night at 10 o'clock; at 1 o'clock, Thursday morning the 17th,

[1] Continued from No. 582, page 93.

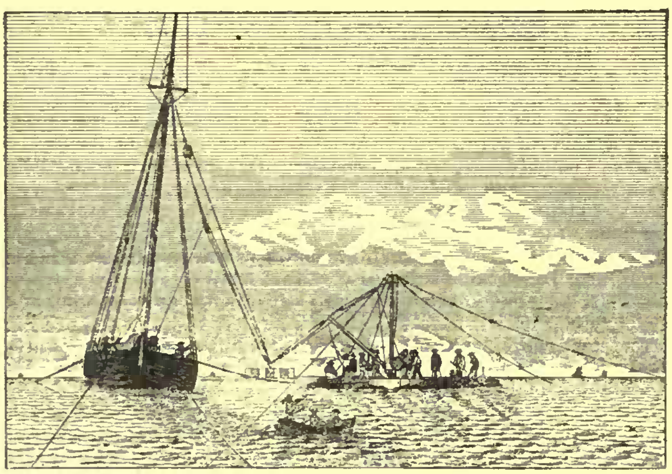
the light-house bell was heard on shore, one-and-one-half miles distant; and this being the hour of high water, or rather the turn of the tide, when from the opposition of the wind and the tide it is supposed that the sea was at its very highest mark; and it was at that hour, it is generally believed, that the light-house was destroyed; at daylight nothing of it was visible from shore, and hence it is most probable it was overthrown at or about the hour named."

The appearance of the site when it was visited on April 22d, is



shown in the sketch. The portion of the wreck of the structure was found one hundred feet from the site.

The second series of horizontal braces was thirty-eight-and-a-half feet above the rock. Captain Swift says: "Upon these braces the keeper had improperly built a sort of deck or platform, upon which were placed heavy articles such as fuel, water-barrels, etc., which should have been in the store-room designed for their reception. The deck, in addition to the weight placed upon it, was fastened together and secured to the piles and braces, thus offering a large surface, against which the sea could strike. In addition to this, the keeper had attached a five-and-a-half-inch hawser to the lantern deck, and anchored the other end to a granite block, weighing, according to his account, seven tons, placed upon the bottom at a distance of some fifty fathoms from the base of the tower. The object of this was to provide means for running a box or landing-chair up and down; but it is very clear that so much surface exposed to the moving sea had the same effect upon the light-house as would have been produced by a number of men pulling at a rope attached to the highest part of



the structure, with the *design* of pulling it down. . . . At 4 o'clock on Wednesday afternoon, the 16th, or ten hours before the light fell, the platform above mentioned came ashore at Cohasset. As this was forty-three feet above the line of low water, and twenty-eight feet above high water, spring tides, the sea had at that time reached within seven feet of the base of the store-room of the light-house. Without undertaking to speculate upon the probable shock that the structure must have received from the effect of the sea upon a platform fastened to the piles forty feet above the rock, it is enough to know that the sea had reached within seven feet of the body or solid part of the structure. Still increasing, it required but a slight increase in the height of the wave, after having reached the deck, to bring it in contact with the main body of the structure. When this took place it is plain to perceive that such a sea, acting upon the surface of the building at the end of a lever fifty or sixty feet long, must be well nigh irresistible, and I doubt not that the light-house was thus destroyed."

Two light-keepers were at the tower, and were involved in its destruction. So far as I know their bodies were never recovered.

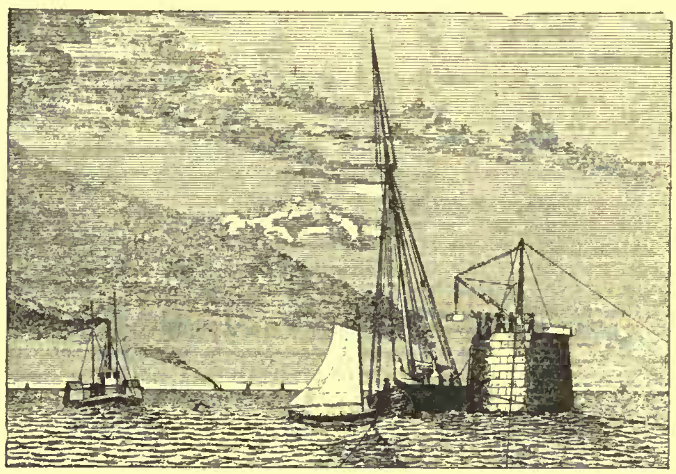
General J. G. Barnard, Corps of Engineers, in his comments on the destruction of this tower says: "In this isolated case of the destruction by wave-violence of a completed structure, there can be little doubt that the engineer's conclusions are correct. The 'main body' (*i. e.* the keeper's dwelling and store-rooms) should never be attainable by waves; all appurtenances, such as scaffoldings (which keepers are so apt to make) and attached hawsers, should be prohibited. A further remark should be made, for in judging of this work it must be borne in mind that it was built at a time when the large grants of money necessary for great engineering works of light-house construction were with difficulty attainable from Congress,[1] at a date, too, when the newly-invented method of skeleton-iron construction for light-houses was still in its infancy.

"The real defect of the Minot iron tower was want of magnitude. It should have had at least a forty-foot base, and a height of one hundred feet. The keeper's dwelling and storerooms could then have been placed beyond the reach of storm waves, the enlarged base affording requisite stability for the increased height. The limited sum at the disposal of the engineer forbade such dimensions. The difficulties of drilling the shaft-holes were, as we have seen, very great, even where the most available parts of the rock were chosen. The enlarged tower, which we *now* know to be necessary, would have cost three times the sum at the command of the engineer."

The importance and necessity to commerce and to life of a light at this point were so apparent that Congress promptly made an appropriation for the purposes of relighting the Minot's Ledge rocks, stipulating, however, that the tower should be erected on the outer Minot and charging the Topographical Bureau with its construction. This Bureau, after advertising for proposals, finally recommended, in view of the great difficulties in the way, and bearing in mind the awful fate of its predecessor, that one of the inner rocks should be selected as the site. While the matter was pending, the present Light-House Board was created (in 1852), and the whole subject was turned over to it.

General G. J. Totten, Chief of Engineers, then a member of the Board, devised the project for the new structure; he advocated and designed a light-house to be erected on the original site. The plans were drawn under his directions and he selected for its execution Captain (afterwards General) Barton S. Alexander, Corps of Engineers, an officer whose experience, skill, boldness and self-reliance eminently fitted him for this arduous task. Alexander thus described the difficulties of the work.

"It was a more difficult work of construction than either the Eddystone, the Bell Rock, or the Skerryvore, for the Eddystone was founded all above low water, part of its foundation being up to high-water level. The foundation of Bell Rock was about three feet above low water, while the Skerryvore had its foun-



dation above high-water level; whereas a good part of the Minot's light was below low water. There had to be a combination of favorable circumstances to enable us to land on the Minot rock at the beginning of that work: *a perfectly smooth sea, a dead calm, and low spring tides.* This could only happen about six times during any one lunation; three at full moon and three at the change. Frequently, one or the other of the necessary conditions would fail; and there were at times months, even in summer, when we could not land there at all. Our working season was from April 1 to September 15. Work was prosecuted with all possible diligence for more than three years before a single stone could be laid. The difficulty was to cut the foundation rock into the proper shape, and then to lay these stones."

Major Ogden, under the orders of the Board, made a careful topographical survey of the rock, with the horizontal curves only three inches apart. The survey showed a plan of the rock at low water, with the curves where horizontal planes, passed three inches from



each other vertically both above and below that level, would intersect the rock, these curves being projected on the rock. This survey showed that the highest point of the rock was three feet six inches above low water, and also that it would not be possible to obtain a tower of greater diameter than twenty-two feet without going outside the low-water limit, but by going outside this limit in five places, a diameter of thirty feet could be obtained.

On the first of May, 1855, Captain Alexander first visited Minot's Ledge; he found the stumps of the broken iron piles on the rock, and the wreck of the old light-house was visible under the water. It was difficult to stand on the rock, covered as it was with mussels and sea-weed; but he succeeded in remaining on it for about an hour, and in remeasuring it at dead low water, with the hope that he could get a few inches more than the thirty feet for the foundation; but in this he was disappointed.

[1] The Minot's light-house cost less than $40,000.

Captain Alexander arrived at the following facts and conclusions: Landings, even in summer, could not be made for weeks at a time; parts of the ledge were always under water, and the remainder was only bare for three or four hours; the space was contracted, and during easterly weather the sea broke with such violence that no coffer-dam was possible. The cutting of the rock into shape would evidently be a long, tedious, troublesome and expensive operation, requiring incessant vigilance and the employment of a large party of skilled workmen with all the necessary tools and implements. To have engaged such a party and placed them on board vessels near the rock with instructions to work at every favorable opportunity would have been an easy matter; but the men would have been idle nine-tenths of the time. Their discipline would become lax; when wanted they would not be at their posts, and even if they had they could not have worked like men inured to daily labor. Their hands and muscles would soon have become soft, and they would shortly have been disqualified for the hard labor and exposure in store for them.

A better plan was, therefore, to combine the operation of cutting down the rock with that of preparing the stone for the tower, and to have both done by the same party of workmen, who would thus have constant employment and full wages. To do this an establishment on shore was necessary, with wharf accommodations, store-rooms, work-shops and a stone-yard. In addition there were required the necessary vessels and boats; a gang of stone-cutters could then work on the ledge when sea, weather and tide would permit, and when these would not they would find full employment on shore cutting stone for the tower. A permanent scaffold on the ledge, not a beacon-house, was considered essential. This was to be a structure of iron, to which the workmen could be secured to prevent their being washed from the rock, and would afford temporary security in case of accident to boats or vessels. It would also answer the purpose of a derrick for laying the lower courses of masonry in the tower, and its legs, being enclosed in the masonry, would be so many huge bolts to secure it to the rock. These ideas were embodied in a report to the Board dated May 31, 1855, and were approved.

On the 20th of June a few men were employed to loosen the wedges around the stumps of the old iron piles, and to remove the mussels from the ledge, which was accomplished in a few days.

The first landing for cutting down the rock was made at daylight on Sunday, July 1, 1855. But a small party of men were employed, and the first season's work was confined to marking points of the various levels which were to be cut away, to cutting level spaces around the rock upon which the workmen could stand and upon which tools could be placed in comparative safety, and in general to laying out work for a larger party the next year.

During the year 1855 there were one hundred and thirty hours' work on the rock. During the season of 1856 the iron scaffold previously mentioned was erected. It consisted of nine wrought-iron shafts inserted into the holes of the old iron light-house, and rising to a height of twenty feet above low water, the whole bound together at the top by a strong wrought-iron frame; these shafts were ten inches in diameter at the bottom and seven inches at the top. It gave great confidence to new hands. By stretching lines between the posts across the rock in various directions, and about two or three feet above it, every workman had something within easy reach to lay hold of when a wave broke over the rock.

This year and nearly the whole of the next was consumed in cutting the rock to receive the masonry: the foundation pit was nearly completed, and in 1857 four stones of the foundation were laid. On the nineteenth of January, 1857, the bark "*New Empire*," loaded with cotton, was thrown against the scaffold and swept it from the rock, breaking off the iron posts very much as those of the iron light-house had broken when it was carried away, and shattering the top of the rock in some places so that a portion of the work of the preceding year had to be done over again; in 1856 and '57 the work on the rock was one hundred and fifty-seven and one hundred and thirty hours respectively.

Although a permanent coffer-dam about this rock was impracticable, temporary coffer-dams around small portions of the rock were of great use, both in completing the foundation-pit and in laying the lower stones of the structure. These coffer-dams were made of sand-bags similar to those used in building sand-bag batteries. The bags were about half filled with sand and, being made of heavy cotton duck, were practically water-tight. They were easily handled. Two or three hundred of these bags built up, at low water, around the small portion of the foundation-pit which it was desired to finish, or where a stone was to be laid in mortar, would keep out the water for fully half an hour if the sea was very smooth; the water in the little pits thus made was then bailed out and by means of large sponges was kept nearly dry. These dams required but a few moments in construction, and, as they were easily removed, they were inexpensive. They enabled the engineers to see that the work was properly done, that the foundation was properly completed, that the wooden patterns for the lower stones were correct, and that the lower stones were laid in a bed of mortar properly spread on its foundation.

Nearly all the stones were thus laid. The lowest stone, laid July 11, 1858, and some others, had to be laid in water. The method for securing a bed of mortar under these stones was as follows: A large piece of thin muslin was spread on the platform and a layer of mortar of the required thickness was then spread over it; the stone was then laid on this bed of mortar, the vertical joints of the stone were then plastered with mortar and the cloth was folded up and laid smooth against these vertical joints, cutting away its superfluous parts. After remaining five or ten minutes the mortar would begin to set so that it and the cloth would adhere to the stone. The stone was then laid in its envelope which protected the mortar from the dissolving action of the water, while it was being lowered into position.

Previous experiments on shore on stone cemented together in this way under water, showed that the mortar would ooze through the cloth and make a good bond to the stone below.

All the lower courses of stone were laid from an iron mast which was set up in the central hole of the former light-house. The machinery and rigging which completed the derrick had to be put on and taken off every day that landings were made for laying masonry. It was of simple construction and so arranged as to float in the water, so that all that had to be done in "stripping the derrick" after a tide's work was over, was to cast the machinery loose from the mast and throw it, with the attached rigging, overboard; it could then be towed to the tender.

The mortar used throughout the work was the best quality of pure Portland cement; no lime nor sand was used.

The sketches show how the stone was landed on the rock at different stages of the work.

During 1858 the foundation-pit was finished and the masonry carried up to the sixth course inclusive; this took two hundred and eight working-hours. In 1859 the tower was finished to the top of the thirty-second course, sixty-two feet above low water, in three hundred and seventy-seven working-hours; and in 1860 the tower was completed, the last stone being laid on the twenty-ninth of June, just five years, lacking one day, from the time the workmen landed on the ledge.

No life was lost nor was any one seriously injured during the building of the light-house.

The following were the principal regulations for the safety of the workmen while cutting-down the ledge and laying the masonry of the foundation:

1. No person should be employed on the work who could not swim, or who could not pull an oar and manage a small boat.

2. No landing should be attempted on the rock from one boat; there must always be, at least, two boats.

3. While the workmen were on the ledge, a small boat, with at least three men in it, should be stationed immediately alongside the rock, on its lee side, to pick up the men who were occasionally washed from the rock.

After the destruction of the scaffold which had been erected on the ledge, a new one was prepared similar to the first, but it was never erected as a scaffold. The eight outer posts, however, were inserted in the eight outer holes of the former light-house, after the masonry of the tower had been carried up to the tenth course, the spaces around the posts being filled with a grout of Portland cement. They are supposed to give additional strength to the tower, holding it more securely to its rock foundation.

The light was exhibited for the first time at sunset, November 15, 1860. The cost of the light-house and of the keeper's dwellings on shore, was $300,000.

The structure is solid, around a central well up to the level of the entrance door. Above that there is a hollow cylindrical space, fourteen feet in diameter, arched over at the level of the cornice; this space is divided into five stories by four iron floors; these five compartments and a sixth immediately under the lantern constitute the keeper's rooms, store-rooms, etc.

The shaft is purely conical, the limited bottom area forbidding the expansion required for the tree-like spread to the base, usual in European sea-rock light-houses, which is now believed to be a useless expense and founded on a false analogy.

The following tables may be useful for reference:

Year.	Working-hours.
1855. Excavating foundation-pit,	130
1856. " " "	157
1857. " " " and laying 4 stones,	130.21 m.
1858. " " " and laying 6 courses,	208
1859. Laying 26 courses,	377

Number of tons rough stone,	3514
" hammered stone,	2367
Number of stones in light-house,	1079
Height from bottom of lowest stone to top of pinnacle,	114 ft. 1 in.
Height of focal plane above lowest point,	96 ft 1 in.
" " " " mean high water,	84 ft. 7 in.
Diameter of third, or first full course,	30 ft.
" top of 22d course (solid part),	23 ft. 6 in.

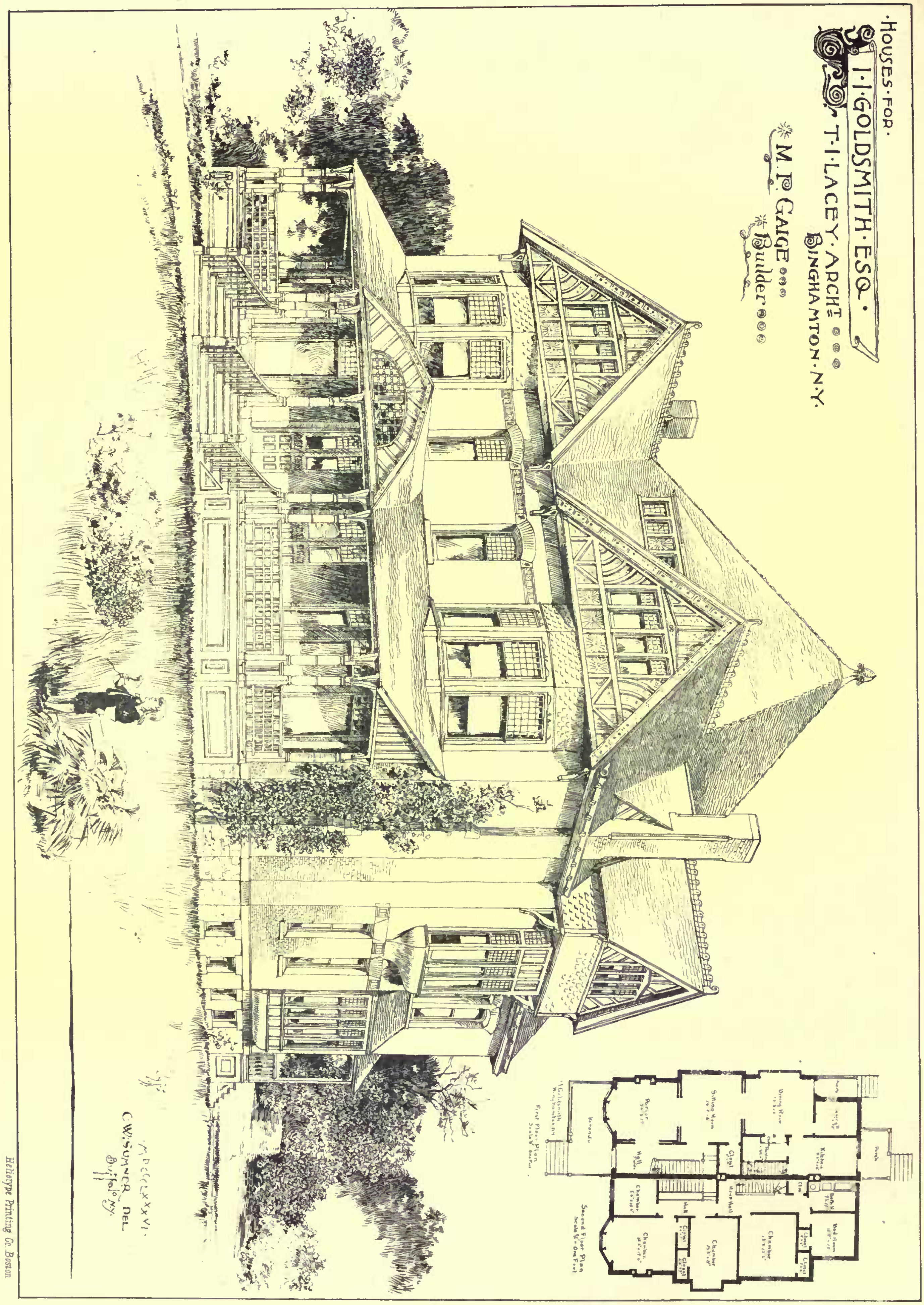
THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

FIRST PARISH CHURCH, MEETING-HOUSE HILL, DORCHESTER, MASS.

[Gelatine Print, issued only with the Gelatine and Imperial Editions.]

THIS building, the successor of several earlier churches, houses the oldest religious society of Boston, as it was organized at Plymouth, Eng., in 1630, before the sailing of the "*Mary and John.*" This building was erected in 1816. On the green in front

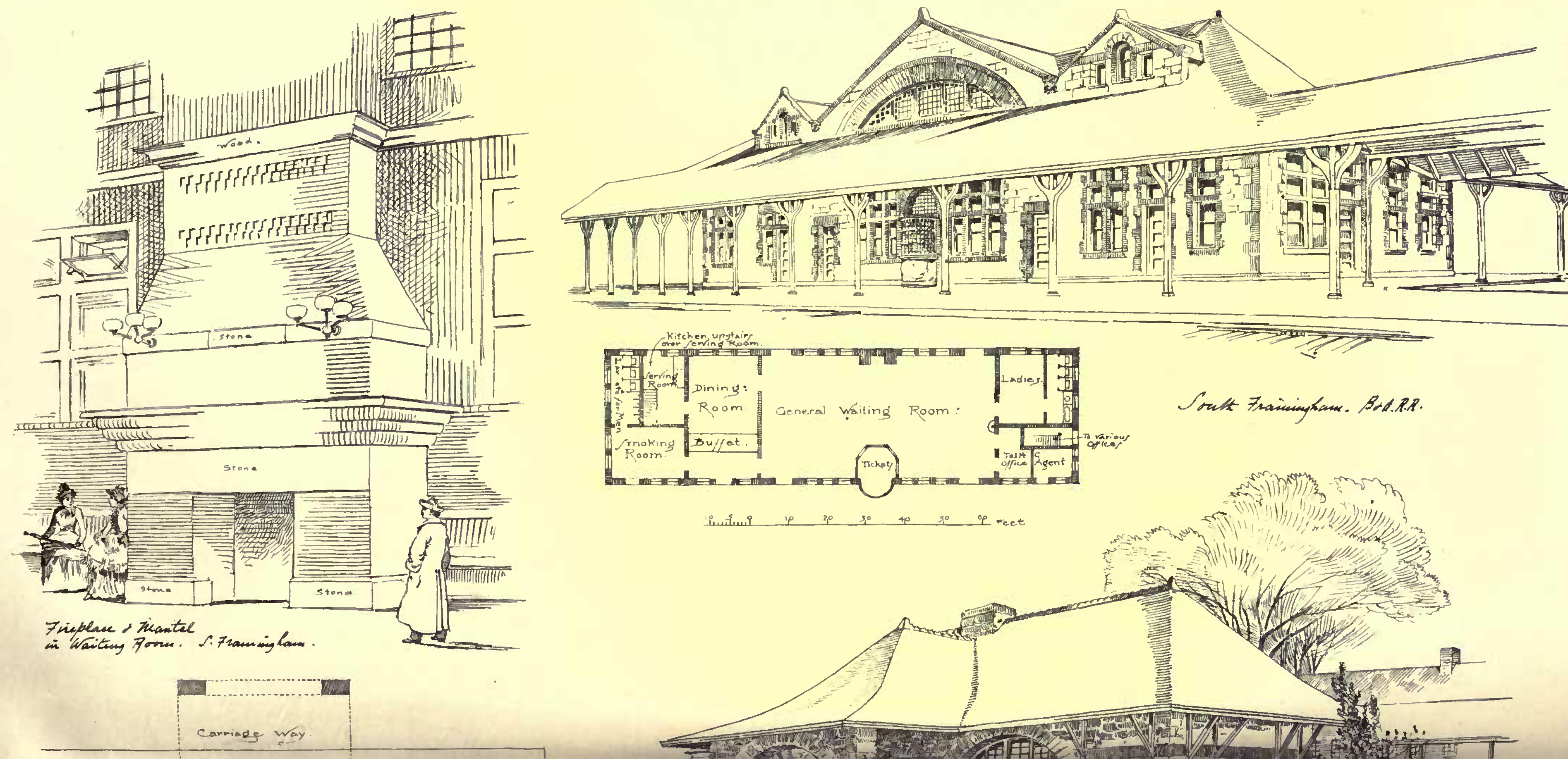


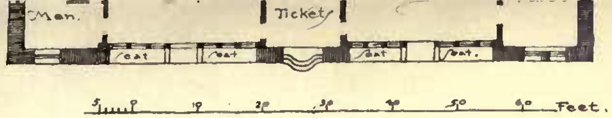
Heliotype Printing Co. Boston

Stations on the Boston & Albany, Old Colony and Connecticut River Railroads. Designed by the late H. H. Richardson. Architect: Brookline: Mass:

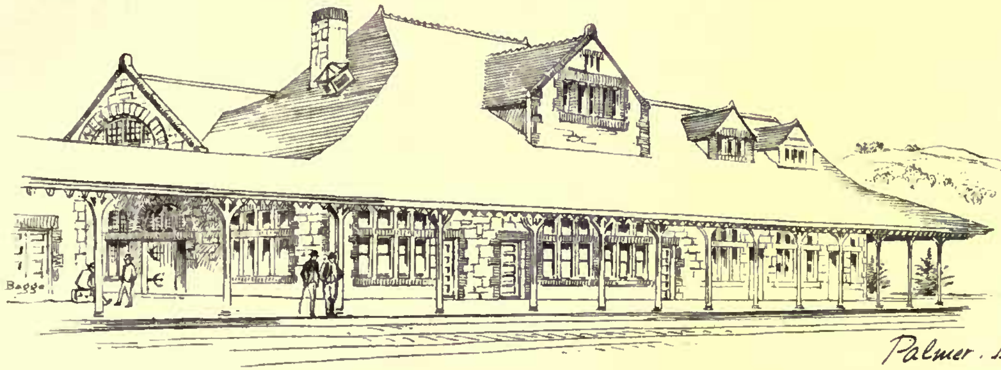
Sheet No 2.

Sketched by E. Eldon Deane.

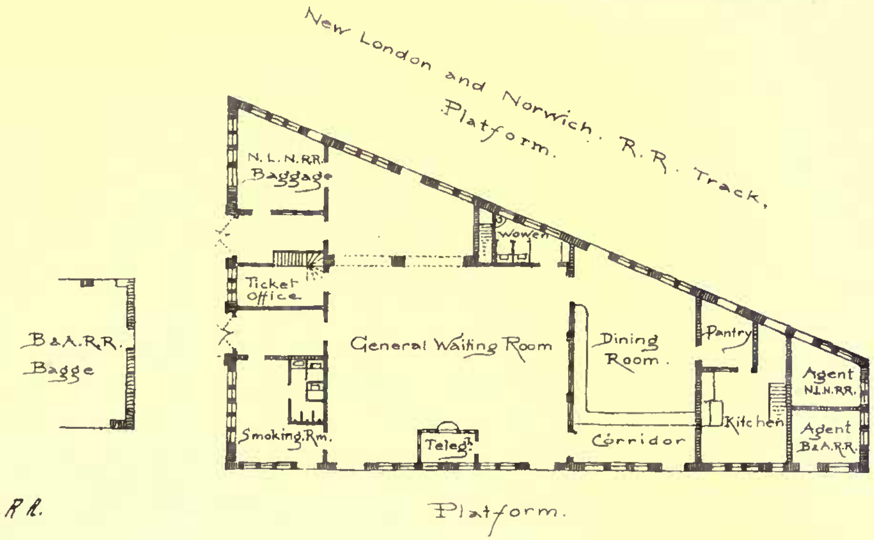




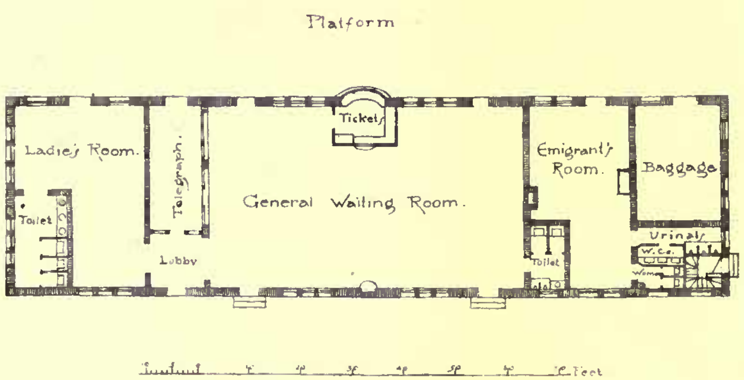
North Easton. O.C.R.R.

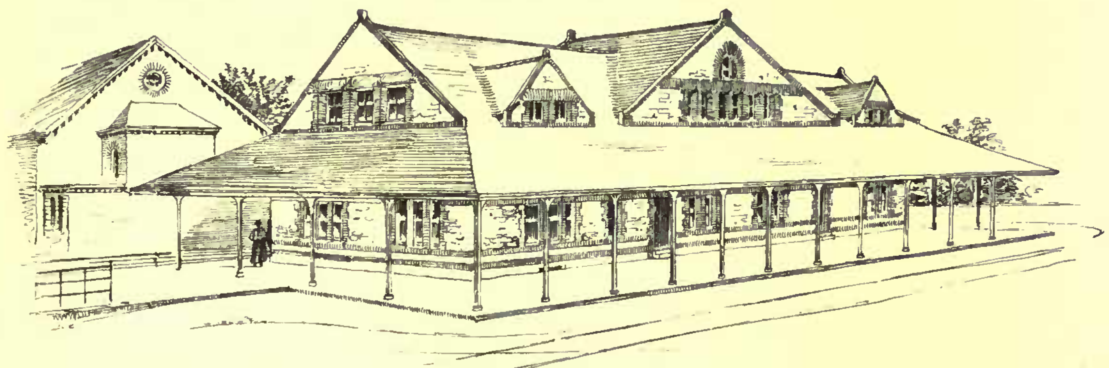


Palmer. B&A.R.R.



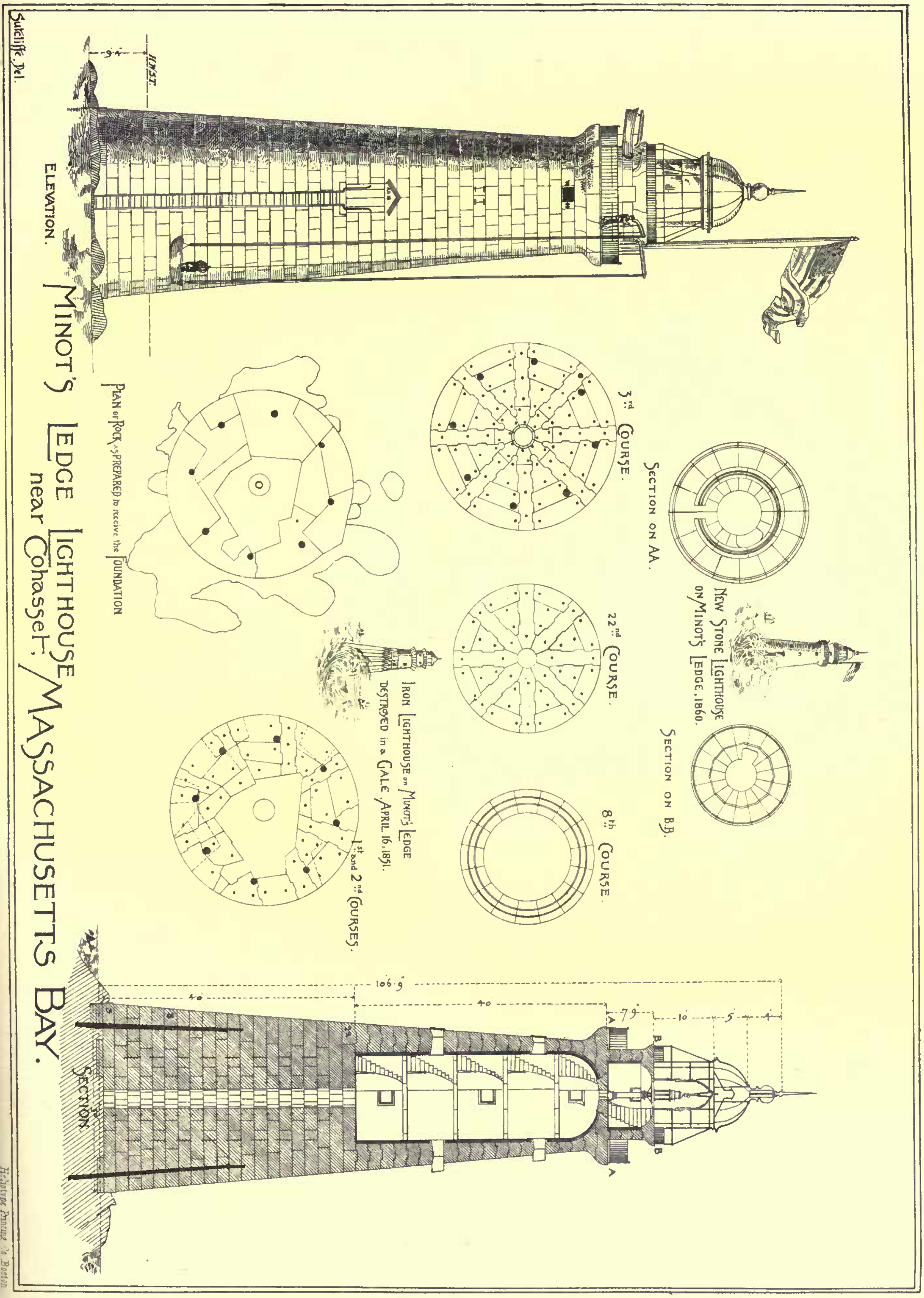
Boston & Albany R.R.d Main Line to Springfield.





Holyoke. Conn: River R.R.

Heliotype Printing Co. Boston


Sutcliffe, Del.
ELEVATION.
H.W.S.T.
SECTION ON AA.
3rd COURSE.
NEW STONE LIGHTHOUSE ON MINOT'S LEDGE, 1860.
SECTION ON B.B.
22nd COURSE.
8th COURSE.
PLAN OF ROCK, AS PREPARED to receive the FOUNDATION
IRON LIGHTHOUSE on MINOT'S LEDGE DESTROYED in a GALE, APRIL 16, 1851.
1st and 2nd COURSES.
MINOT'S LEDGE LIGHTHOUSE near COHASSET, MASSACHUSETTS BAY.
106·9
40
40
7·9
10
5
A
B
B
A
SECTION.
Heliotype Printing Co Boston

stands the monument to the memory of the soldiers of Dorchester who fell in the civil war.

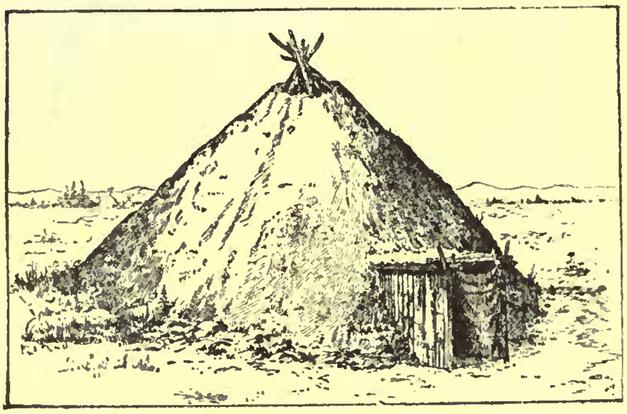
RAILWAY STATIONS AT WELLESLEY HILLS, WABAN, WOODLAND, AUBURNDALE, BRIGHTON, SOUTH FRAMINGHAM, PALMER, HOLYOKE, AND NORTH EASTON, MASS., DESIGNED BY THE LATE H. H. RICHARDSON, ARCHITECT.

MINOT'S LEDGE LIGHT-HOUSE, BOSTON HARBOR, MASS.

FOR description see article on "Ancient and Modern Light-Houses," elsewhere in this issue.

HOUSE OF I. I. GOLDSMITH, ESQ. MR. T. I. LACEY, ARCHITECT, BINGHAMTON, N. Y.

HABITATIONS AFFECTED BY ENVIRONMENT.



A Navajo Hut.

BY the courtesy of Major Powell, Director of the Ethnological Bureau, we are enabled to publish from the advance sheets of his forthcoming report, the following portion of Mr. F. H. Cushing's interesting "Study of Pueblo Pottery as Illustrative of Zuñi Culture-growth :"

It is conceded that the peculiarities of a culture-status are due chiefly to the necessities encountered during its development. In this sense the Pueblo phase of life was, like the Egyptian, the product of a desert environment. Given that a tribe or stock of people is weak, they will be encroached upon by neighboring stronger tribes, and driven to new surroundings if not subdued. Such we may believe was the influence which led the ancestors of the Pueblo tribes to adopt an almost waterless area for their habitat.

It is apparent at least that they entered the country wherein their remains occur, while comparatively a rude people, and worked out there almost wholly their incipient civilization. Of this there is important linguistic evidence.

A Navajo hogan, or hut, is a bee-hive shaped or conical structure of sticks and turf or earth, sometimes even of stones chinked with mud. Yet its modern Zuñi name is *hám' pon ne*, from *ha we*, dried brush, sprigs or leaves; and *pó an ne*, covering, shelter or roof (*po a* to place over and *ne* the nominal suffix) ; which, interpreted, signifies a "brush or leaf shelter." This leads to the inference that the temporary shelter with which the Zuñis were acquainted when they formulated the name here given, presumably in their earliest condition, was in *shape* like the Navajo hogan, but in *material* of brush or like perishable substance.

The archaic name for a building or walled inclosure is *hé sho ta*, a contraction of the now obsolete term, *hé sho ta pon ne*, from *hé sho*,



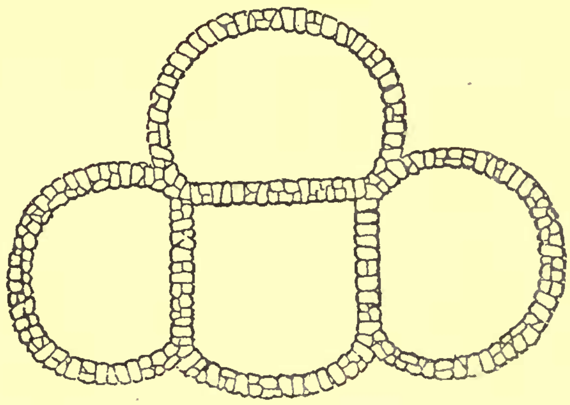
View of earliest, or Round-house Structure of Lava.

gum, or resin-like ; *shó tai e*, leaned or placed together convergingly ; and *tá po an ne*, a roof of wood or a roof supported by wood.

The meaning of all this would be obscure did not the oldest remains of the Pueblos occur in the almost inaccessible lava-wastes bordering the southwestern deserts and intersecting them, and were not the houses of these ruins built on the plan of shelters, round rather than rectangular. Furthermore, not only does the lava-rock of which their walls have been rudely constructed resemble natural asphaltum (*hé sho*), and possess a cleavage exactly like that of piñon-gum and allied substances (also *hé sho*), but some forms of lava are actually known as *á he sho* or gum-rock. From these considerations inferring that the name *hé sho ta pon ne* derivatively signifies something like "a gum-rock shelter with roof supports of wood," we may also infer that the Pueblos, on their coming into the desert regions, dispossessed earlier inhabitants, or that they chose the lava-wastes the better to secure themselves from invasion; moreover that the oldest form of building known to them was therefore an inclosure of lava-stones, whence the application of the contraction *hé sho ta* and its restriction to mean a walled enclosure.

RECTANGULAR FORMS DEVELOPED FROM CIRCULAR.

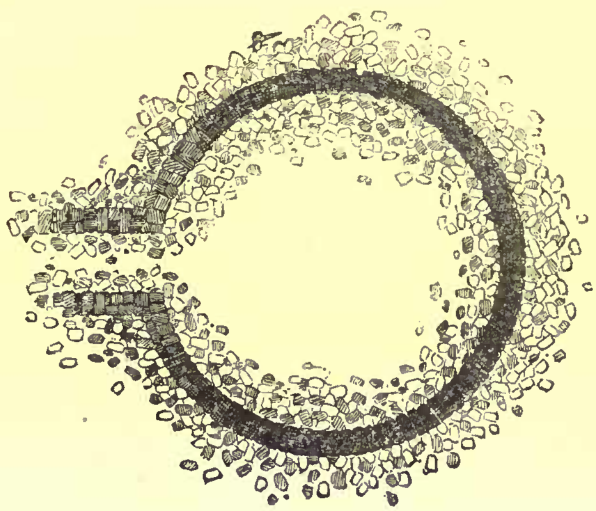
It may be well in this connection to cite a theory entertained by Mr. Victor Mindeleff, of the Bureau of Ethnology, whose wide experience among the southwestern ruins entitles his judgment to high



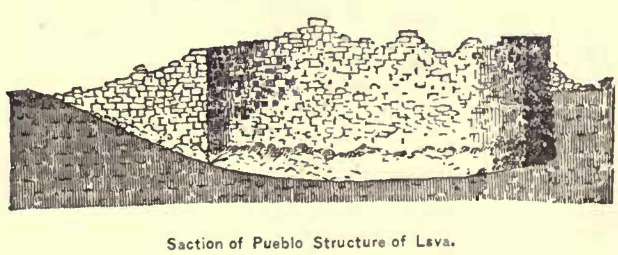
Evolution of rectangular forms in Primitive Architecture.

consideration. In his opinion the rectangular form of architecture, which succeeds the type under discussion, must have been evolved from the circular form by the bringing together, within a limited area, of many houses. This would result in causing the wall of one circular structure to encroach upon that of another, suggesting the partition instead of the double wall. This partition would naturally be built straight as a twofold measure of economy. Supposing three such houses to be contiguous to a central one, each separated from the latter by a straight wall, it may be seen that the three sides of a square are already formed, suggesting the parallelogramic as a convenient style of sequent architecture.

All this, I need scarcely add, agrees not only with my own observations in the field but with the kind of linguistic research above recorded. It would also apparently explain the occurrence of the



Plan of Pueblo Structure of Lava.



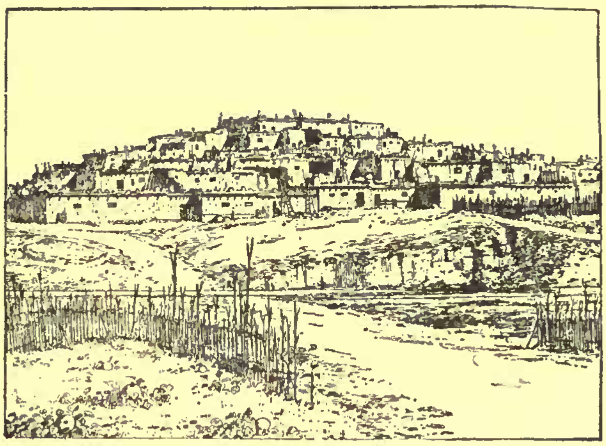
Section of Pueblo Structure of Lava.

circular semi-subterranean *kí wi tsi we*, or estufas. These being sacred, have retained the pristine form long after the adoption of a modified type of structure for ordinary or secular purposes, according to the well-known law of survival in ceremonial appurtenances.

In a majority of the lava ruins (for example those occurring near Prescott, Arizona), I have observed that the sloping sides rather than the level tops of *mesa* headlands have been chosen by the ancients as building-sites. Here, the rude square type of building prevails, not, however, to the entire exclusion of the circular type, which is represented by loosely-constructed walls, always on the *outskirts* of the main ruins. The rectangular rooms are, as a rule, built row above row. Some of the houses in the upper rows give evidence of having overlapped others below.

FLAT AND TERRACED ROOFS DEVELOPED FROM SLOPING MESA SITES.

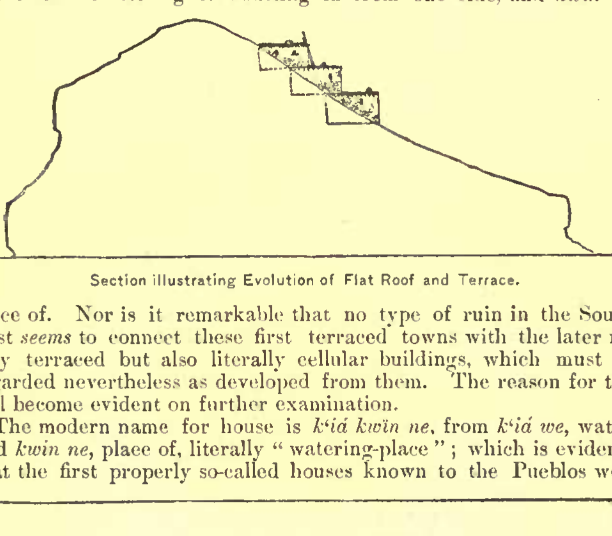
We cannot fail to take notice of the indications which this brings before us.



Typical Terraced Communal Pueblo.

(1) It is quite probable that the overlapping resulted from an increase in the numbers of the ancient builders relative to available area, this, as in the first instance, leading to a further massing together of the houses. (2) It suggested the employment of rafters and the formation of a *flat* roof as a means of supplying a level entrance-way and floor to rooms which, built above and to the rear of a first line of houses, yet extended partially over the latter. (3) This is, I think, the earliest form of the terrace.

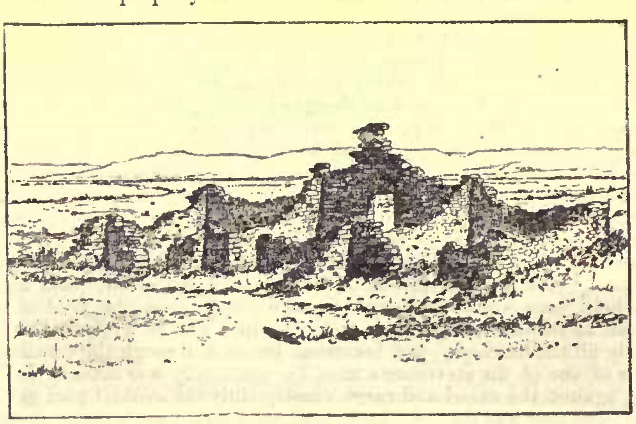
It is, therefore, not surprising that the flat roof of to-day is named *té k'os kwïn ne*, from *te*, space, region, extension, *k'os kwi e*, to cut off, in the sense of closing or shutting in from one side, and *kwïn ne*,



Section illustrating Evolution of Flat Roof and Terrace.

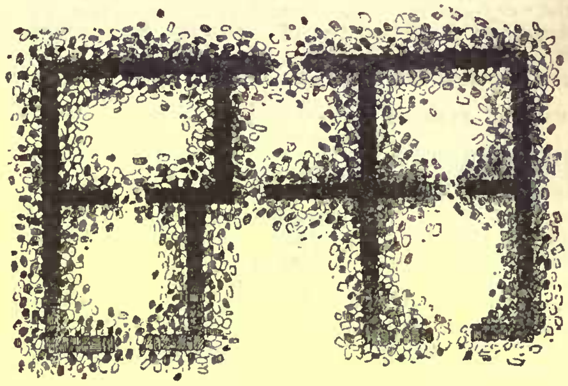
place of. Nor is it remarkable that no type of ruin in the Southwest *seems* to connect these first terraced towns with the later not only terraced but also literally cellular buildings, which must be regarded nevertheless as developed from them. The reason for this will become evident on further examination.

The modern name for house is *k'iá kwïn ne*, from *k'iá we*, water, and *kwïn ne*, place of, literally "watering-place"; which is evidence that the first properly so-called houses known to the Pueblos were



View of Typical Solitary House.

solitary and built near springs, pools, streams, or well-places. The universal occurrence of the vestiges of single houses throughout the less-forbidding tracts of the Pueblo country leads to this inference and to the supposition that the necessity for protection being at last overcome, the denizens of the lava-fields, where planting was well-nigh impossible, descended, building wherever conditions favored the horticulture which gradually came to be their chief means of support. As irrigation was not known until long afterwards, arable areas were limited; hence they were compelled to divide into families or small clans, each occupying a single house. The traces of these solitary farm-houses show that they were at first single storied. The name of an upper room indicates how the idea of a second or third story was



Plan of Typical Solitary House.

developed, as it is *ósh ten u thlan*, from *ósh ten*, a shallow cave, or rock-shelter, and *ú thla nai e*, placed around, embracing, inclusive of. This goes to show that it was not until after the building of the first small farm-houses (which gave the name to houses) that the eaves or rock-shelters of the cliffs were occupied. If predatory border-tribes, tempted by the food-stores of the horticultural farm-house builders, made incursions on the latter, they would find them, scattered as they were, an easy prey.

ADDED STORIES OF CLIFF-DWELLINGS DEVELOPED FROM LIMITATIONS OF CLIFF-HOUSE SITES.

This condition of things would drive the people to seek security in the neighboring cliffs of fertile cañons, where not only might they build their dwelling-places in the numerous rock-shelters, but they could also cultivate their crops in comparative safety along the limited tracts which these eyries overlooked. The narrow foothold



A Typical Cliff-Dwelling.

afforded by many of these elevated cliff-shelves or shelters would force the fugitives to construct house over house; that is, build a second or upper story around the roof of the cavern. What more natural than that this upper room should take a name most descriptive of its situation — as that portion built around the cavern-shelter or *ósh ten* — or that, when the intervention of peace made return to the abandoned farms of the plains or a change of condition possible, the idea of the second story should be carried along and the

name first applied to it survive, even to the present day? That the upper story took its name from the rock-shelter may be further illustrated. The word *ósh ten* comes from *ó sho nan te*, the condition of being dusky, dank, or mildewy; clearly descriptive of a cavern, but not of the most open, best lighted, and driest room in a Pueblo house.

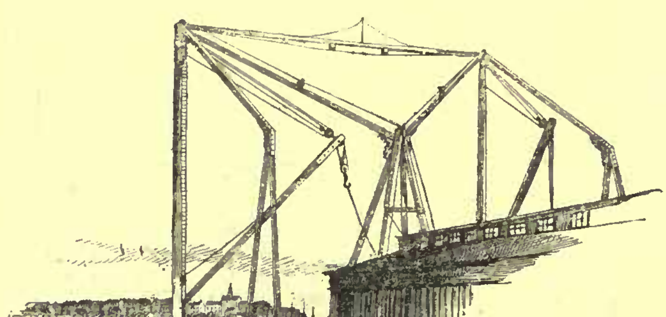
To continue, we may see how the necessity for protection would drive the petty clans more and more to the cliffs; how the latter, at every available point, would ultimately come to be occupied, and thus how the "*cliff-dwelling*" was confined to no one section, but was as universal as the farm-house type of architecture itself, so widespread, in fact, that it has been heretofore regarded as the monument of a great, now extinct, *race* of people!

COMMUNAL PUEBLOS DEVELOPED FROM CONGREGATION OF CLIFF-HOUSE TRIBES.

We may see, finally, how at last the cañons proved too limited and in other ways undesirable for occupation, the result of which was the confederation of the scattered cliff-dwelling clans, and the construction, first on the overhanging cliff-tops, then on *mesas*, and farther and farther away, of great, many-storied towns, any one of which was named in consequence of the bringing together in it of many houses and clans, *thlu él lon ne*, from *thlu a*, many springing up, and *él lon a*, that which stands, or those which stand; in other words "many built standing together." This cannot be regarded as referring to the simple fact that a village is necessarily composed of many houses standing together. The name for any other village than a communal pueblo is *ti na kwïn ne*, from *ti na* — many sitting around, and *kwïn ne*, place of. This term is applied by the Zuñis to all villages save their own and those of ourselves, which latter they regard as Pueblos, in their acceptation of the above native word.

Here, then, in strict accordance with the teachings of myth, folklore and tradition, I have used the linguistic argument as briefest and most convincing in indicating the probable sequence of architectural types in the evolution of the Pueblo; from the brush-lodge, of which only the name survives, to the recent and present terraced, many-storied, communal structures, which we may find throughout New Mexico, Arizona, and contiguous parts of the neighboring territories.[1]

TWO MONSTER CRANES.



Double Crane . Fiske's Wharf. Boston. Mass.

SIXTEEN powerful horses, four abreast, attached to a low four-wheeled caravan, upon which was a twenty-eight-ton block of Italian marble, were noticed, the other day, says a writer in the *Boston Herald*, issuing from the gateway of Fiske's wharf, Commercial Street, where, by the way, every ton of foreign marble coming to the port of Boston is handled. The writer sought Mr. Nichols, the wharfinger, and was invited to witness the unloading of the bark "*Anita Menotti*," from Leghorn, then discharging a cargo of nine hundred tons of sculptors' marble. Employed in this work were two monster cranes, which were seen in operation. These cranes are said to be unlike any others in the country, in that they can handle almost unlimited weights with the greatest ease. Incidentally, it may be said, that this machinery put into position the masts of the "*Puritan*," "*Gitana*," "*Fortuna*," "*Mayflower*," and other crack yachts, and hardly a day passes but they are used to lift out the spars of vessels of our merchant fleet, doing it in a twinkling, without even the necessity of unshipping topmasts. Only a few days ago a capsized mud-scow was towed alongside the wharf; three strong chains were quickly passed under the scow and fastened to the under near edge; the machinery was put in motion, and in a trice the scow was floating on its bottom, righted. A large-sized yacht was recently brought to the wharf on the deck of a Leyland line steamer; strong cable straps were attached, and quicker than it takes to tell it, the yacht was in the air, and by rotating the crane was landed in the water hard by.

An immense planer, weighing forty tons, which had taken ten hours to stow in the hold of a vessel, was brought under the crane to be lifted out; the hydraulic jacks lifted the planer so that straps could be fastened around it, and the wharf-machinery quickly snaked it immediately under the main hatch; the ropes, or slings, and three-foot "S" hook and blocks, suspended from the boom of the crane, were swung over and made fast; the engine puffed, the gearing strained and cracked, the great machine was slowly elevated twenty feet above the vessel's deck, the crane revolved on its axis, and the machine was landed safely upon the huge caravan standing near at hand to receive it. It required twenty horses to drag the van through the city to South Boston, its intended destination. Permission to go over Federal-street bridge could not be obtained unless the shippers would lay a new and special flooring on the bridge proper. This was done, and as the wheels of the van passed over the flooring the crushed wood curled up after each wheel, as snow does behind the cart-wheel in winter. The machine was soon safely landed and placed in position.

From the above illustrations the immense power of the cranes can be readily conceived. Mr. Nichols, the wharfinger, conducted the writer to the end of the wharf, introducing him to Tim Tutein the crack stevedore, who, with his men, eight in number, was unloading the marble cargo of the "*Menotti*." Great blocks of marble, weighing from ten to thirty tons, were issuing from the hold of the bark in quick succession, and by the swinging cranes they were safely deposited in positions on the wharf, as though they did not weigh as many pounds as was their weight in tons. The ship was nearly empty, only forty hours having been employed to discharge the nine-hundred-ton cargo, and all of this time was not all employed on the work, one crane being most of the time used on mast work.

To give a minute description of the cranes would occupy too much space, but an idea may be obtained from the following figures and explanation: A few feet from the end of the wharf stands a mast ninety feet high and thirty inches in diameter at the base. Springing out, some ten feet above the step of the mast, is a boom sixty feet long and twenty inches in diameter. The step is of heavy iron castings, arranged so that a rotary motion of the whole rigging can be had at will; from the engine-house, twenty-five feet in the rear, comes a seven-inch manila rope, passing over a monster drum, thence under the flooring of the wharf, around a lateral sheave, thence to the centre of the mast, piercing its core and coming out at the boom; then it runs over another sheave to the tip end of the boom, where it runs over another twenty-inch sheave, one of three set in the centre of the boom. From there it passes into two five-sheave pulley-blocks, forming with the sheaves in the boom a five-part tackle. The pulley-blocks are huge affairs, being about three feet long by two feet wide, made entirely of steel and wrought-iron. Another seven-inch rope is used as a boom fall, this rope passing from the engine-house through the roof and over the large stationary wooden guys which hold it in position. There are eighty-five fathoms of rope in the mast fall and seventy fathoms in the boom fall. The stationary iron collar in which the head of the mast revolves, and to which the ends of the guys are fastened, weighs seven hundred pounds; the head of the mast revolves in this collar upon round steel balls, which give it a ball-bearing action. The rotating gearing at the base of the mast allows the crane to swing around as desired and deposit its load wherever wished, within a radius of sixty feet. The guys which stay the mast in position are wooden, and lead down to the top of an "A" base of 12″ x 12″ hard-pine timbers, fastened with hackmatack knees and wrought-iron straps at every angle. The timbers of the braces are of the same size as those of the guys, and fastened to the wharf in the same manner. The guys referred to meet those of the "sister crane," a duplicate of the one described, about forty feet distant, and together make the support for each perfect. The lifting-capacity of these cranes is almost unlimited, and it is conceded that they are the most powerful stationary lifting and rotating derricks in the country, taking into consideration the immense sweep they have and the height to which freight can be raised. Since their erection by Mr. Nichols, who designed them, not an accident has happened, for Mr. Tutein, who gives his "pets," as he calls them, his personal attention, will not allow a rope or fall to be used after it has been strained to the extent imposed upon it in the lifting of a certain number of tons weight. Although the rope may look strong and without signs of wear, it is taken off, cut up in cable straps and bands, and a brand-new seven-inch manila rope substituted; this, doubtless, is a very wise precaution, as the dearth of accidents attests. "As an example of the strength of the crane," said Mr. Nichols, "one was at work not long ago lifting from the hold of a vessel an immense weight, the bulk of which was so great as to entirely fill the hatchway, and becoming jammed, through the carelessness of one of the stevedore's men, the machinery was actually pulling against the vessel and cargo, consequently the weakest part gave way, and that was the "S" hook, a gigantic affair, made of the finest three and one-half-inch Swedish iron, parting it in the middle as though it had been a piece of putty. Since then "S" hooks, before being used, are tested to sustain a weight equal to one hundred tons." Mr. Nichols further said that had he been wiser he would have patented his cranes, for mechanical engineers have credited him with

[1] See for confirmation the last Annual Report to the Archæological Institute of America, by Adolph F. Bandelier, one of the most indefatigable explorers and careful students of early Spanish history in America.

designing the best crane extant, as the number now being erected from his plans in various parts of the country attest.

DISINFECTION AT BERLIN.



FROM REVOIL'S ARCHITECTURE ROMANE.

IN the Paris *Journal d'Hygiène* for the 6th of January, the editor, Dr. de Pietra Santa, devotes several pages to a highly-interesting and instructive review of the progress of municipal cleanliness in the city of Berlin, since the alarm created by the great small-pox epidemic of 1871–2. The material is obtained from a professional report by MM. Alfred Durand-Claye and Albert Petsche, in which modern European experience on a large scale is adduced to show that the problem of the purification of towns, and the suppression of the epidemic form of the zymotic diseases can be solved by the adoption of the three following measures:

1. Removal of liquid refuse and excreta by sewerage.

2. Sufficiency of water-supply for household purposes and flushing of sewers.

3. Deodorization of the sewage by utilizing it on sewage-farms. The application of these wise and practical principles to Berlin, says Dr. de Pietra Santa, is producing the anticipated results. The condition of this city, which fifteen years ago was detestable, is now much improved by the progress already made in carrying out the above-named measures. The city is not favorably situated for drainage, lying in a flat and sandy plain, and being intersected by the various arms of the sluggish Spree. The water-level, too, is in some parts but a few feet below the surface. Those who may have visited the capital in 1873 or earlier, will remember the deplorable state of its ill-paved streets, the deep and odorous gutters, receptacles of rainfall, of house sewage, and often of excreta, bridged over by planks giving access to the dwellings; the discolored and fœtid river, gliding slowly through the city, being the common reservoir. The dwellings were provided with cesspits, or more commonly with deep cavities, by means of which fæcal matters were enabled to percolate into the subsoil; and much of the water-supply was obtained from private or public wells excavated in this dangerously-polluted material. Under these unfavorable conditions, it is not surprising that the mortality of the city reached in 1871 the high figure of thirty-nine in the thousand of population. The extent of zymotic mortality at length aroused the authorities, and the Berlin municipality determined on making a supreme effort to free the city from conditions so prejudicial to public health, and so mortifying to the national pride.

The new water-works were undertaken by an English company; the general plan for the purification of the city, and the closing of the reign of epidemics, was approved in 1873, and operations were commenced in 1874. In ten years the greater part of the colossal work was completed, and at the present time nearly all Berlin is living (says Dr. de Pietra Santa) under arrangements which many a European capital might envy. Streets have been relaid and repaved after the most approved pattern; an increase in the water-supply has been obtained by attaching filter-beds to the lakes in the vicinity, and the radial system of sewers is an excellent method of conveying to the separate sewage-farms the various impurities of the city. The thin stratum of sandy soil in the environs reposes on a difficult subsoil, necessitating lessened doses of sewage and farms of greater extent; yet no complaint is raised in the neighborhood, although it comprises many suburban dwellings. The success of the new sewerage is incontestable. The prophets of failure are silent, and there is a general desire to connect the dwelling with the sewer. Although the work is still incomplete, there has been a satisfactory reduction in mortality, especially in that from typhoid fever. The great problem of the purification of a large capital has thus been solved in a remarkable manner. In 1873 everything had to be done, and in the forthcoming year it is expected that the work will be completed.

These interesting details of sanitary effort in Berlin, supported by the experience of our own metropolis, furnish a further and striking confirmation of the power of municipal cleanliness, when thoroughly brought into action, in the speedy removal of liquid and solid refuse, to seriously mitigate, if not absolutely to avert, the epidemic form of any and every zymotic disease.

The Berlin authorities are proud of the reduction effected in typhoid fever; they have equal cause for pride in the reduction, by the same means, of the mortality from small-pox, which in the face of unbounded pressure of vaccination and revaccination for a series of years, destroyed 6,478 citizens in the epidemic of 1870–72, but has since been compelled to content itself, from 1875 onwards, with a mortality too insignificant to particularize. — *H. D. Dudgeon in the Sanitary World.*

THE "*TRANSACTIONS*" OF THE ROYAL INSTITUTE OF BRITISH ARCHITECTS.

IT may not be generally known that, during the past year, the volume of "*Transactions*" of the Royal Institute has served to increase the customs revenue of the United States. In one prosperous city a collector of customs has had the volume before him, has examined it, has discovered that it consists of two or three numbers of a serial bound in one, that its cover, though a paper one, is of two or three papers stuck together — a stiff cover being, to transatlantic customs officials, an irritant inducive of taxation — that, in fine, it is a periodical which makes money, and out of which money ought to be made. The result is that four Honorable Corresponding Members, eight institutions, and two newspapers, located in the United States, have each, presumedly, had to pay duty for the volume (II, new series), presented to them, post-paid, in November last. Had, however, the "*Transactions*" been sent in three parts separately, as each part appeared, it is stated that they would have been admitted free; and consequently future issues intended for the United States will be sent in that manner. The United States are apparently alone, among the nations of the world, in levying toll on a private gift made by the architects of this country to honored *confrères* (not their own countrymen), and to kindred institutions abroad.

The facts, nevertheless, are these: Every year, of late years, the Royal Institute makes up 1,500 volumes of its "*Transactions*," independently of "short" copies of papers, of a few separate parts, and of this *Journal of Proceedings*. The volumes, published in October, are issued during the month to members, and every member, subscribing or non-subscribing, receives a copy. About thirty members prefer to receive the "*Transactions*" in three parts instead of in a complete volume, and consequently a certain number of copies, sewn in a thin cover, are issued to those gentlemen in January, April and August, and it is always possible for members, both at home and abroad, to obtain the work in this divided form. Those who reside abroad are alone asked, as a matter of precaution, to return a printed letter of acknowledgement which is sent in the packet containing the volume, and the majority, perhaps, have complied with this request. Where, in particular cases, no notice has been taken for any length of time of the receipt of the volume, the further issue of the R.I.B.A. publications is suspended, at least until some intimation arrives of the actual existence or whereabouts of the member in question. The same course is pursued with institutions, and until a receipt is received from their secretaries, or their librarians, for which a due allowance of time is always given, the further issue ceases. This course is necessitated by many reasons, not the least being the increased size and cost of the volumes of "*Transactions*," the increased demand for them by societies and educational bodies, and the comparatively large outlay for foreign and colonial postage. At present ninety-four institutions, exclusive of newspapers, periodically receive the publications of the Royal Institute, and this over and above those sent to members. Of the ninety-four copies, sixty-seven are distributed throughout Great Britain and Ireland, and twenty-seven abroad. Besides which, the Governments of India, of Madras, and of Bombay, receive nine copies (three to each); moreover, among the foreign Honorary Corresponding Members, Austria and Germany receive eleven copies, Denmark two, France, Holland and Belgium twenty-six, Greece one, Italy six, Russia two, Spain and Portugal three, and the United States four copies. No encouragement is given to the public sale of these volumes, for no reduction is allowed on them to the trade. A member may purchase extra copies, and if he do so he is allowed a discount of twenty-five per cent, but outsiders and the trade have to pay the full price. Indeed, far from any attempt to make a profit out of such publications, the Royal Institute has studiously done its best to render such a result impossible; and strange as it may sound to commercial ears, in these go-a-head days, more heed has been always given to applications from the chiefs of libraries and schools, and from architectural societies, asking to be presented with these works, than to outsiders who have offered to pay for them.

SOCIETIES

A CINCINNATI SKETCH-CLUB.

CINCINNATI, February 19, 1887.

THE architectural draughtsmen and students in the various offices have just organized themselves as a sketch-club, and from all appearances the organization promises to be of considerable benefit to the architects as well as to the students, from the fact that the architects will indirectly reap the fruits of the knowledge and zeal that is sure to result to the young men in their studies.

The architects have given the movement their approval and each one in his turn is to be called upon to act as critic in the friendly competitions to be instituted among the juniors.

CHARLES CRAPSEY.

A CORRECTION.

CLEVELAND, OHIO.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,— The president of the Ohio State Association of Architects, Mr. C. F. Schweinforth, is of Cleveland, and not of Dayton, as stated in your issue of February 12, page 73.

Very truly, F. A. COBURN, *Secretary.*

BOOKS AND PAPERS

JUST too late to be of avail as a somewhat expensive souvenir of the two hundred and fiftieth anniversary celebration of Harvard College, was published the fourth of the series of "*Monographs of American Architecture,*[1]" devoted to the treatment of Memorial Hall — Alumni Hall, we believe, is its proper and somewhat hybrid name — a building which, besides its reflected glory as the central feature of the present University buildings, will always have considerable interest for architects. For those who know the history of the building and the manner in which a comparatively modest design was expanded and developed, as more and more money was dropped — not poured — into the coffers of the building-committee, it is easy to see in the completed work where the architects found themselves in a po ition to re-study and enlarge on their original design. For our own part we have always regretted that the original design was not more closely adhered to; it was more scholastic and in keeping with the modest merits of the other college buildings, though perhaps as a memorial of high achievements in paths widely divergent from the peaceful walks of scholars, the more aspiring structure is the more fit. Certainly from many points of view the building is a success, and if one could forget the "asses' ears," which, as roofs to the pavilions at the base of the great tower, contend so masterfully for the observer's attention, the building externally would meet with little but approval. But it is within that the architects have succeeded best. The vestibule — the memorial hall proper — is an imposing apartment, and one can easily forgive the wooden groining of the ceiling and overlook the not too successful attempt at polychromy in the heads of the marble memorial tablets, which recalls the still more distressing polychromatic vagaries practised in the slating of the roofs. The dining-hall is probably one of the most successful rooms in the country, not only from the architectural but from the practical standpoint, and its acoustic properties are unusually good. Here, too, can be seen some of the best of the work of modern glass-stainers, shown in memorial windows presented by different classes. Although several of these windows have been put in place within the last year or two, still the great west window, which was set when the building was still in the hands of the architects, holds its own marvellously as a very satisfactory piece of color-work,— extraordinarily so, considering the state of the glass-stainer's art at that time in this country. But perhaps the part of the structure which is the most successful, as it was the most likely to result in a failure, is the Sanders Theatre, where all the public literary exercises take place. In arrangement this part of the building is as convenient and commodious as space would allow; in color it is quiet and soothing, and its acoustic properties, the all-important desideratum, are said to be all that could be desired. We believe that it is considered the best hall for the rendition of music in the neighborhood of Boston, the city itself included.

The gelatine prints which exhibit the merits of the building are in keeping, as to quality, with those issued in former numbers of the series, and they give an excellent idea of a very large and important structure.

COMMUNICATIONS

ADVICE TO ARCHITECT SUITORS.

MACON, GA., February 15, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,— The Albany architect who writes you about a suit he has commenced against a client, if he were to consult a large number of his professional brethren, would probably receive from most of the older ones some such *report* as I propose to make to him.

I was "articled" in an architect's office on the 1st November, 1850, and since that time have learned several things, one of them being that an architect can scarcely make a poorer use of his time than to use it in a law suit. It is true I have never taken a client into court, and never intend to, but I have often seen it done.

I conclude that it does n't pay. If your client does n't want to settle on your terms, offer to settle on his terms. If he refuses to settle at all, tell him to go to —— well, Jericho, that being a road supposed to be travelled by thieves.

Peace of mind is too valuable and too scarce in an architect's office, to be sacrificed for the largest fee an architect was ever defrauded of; though my experience would lead me to believe that an architect's clients are, for the most part, good people, who mean to pay and are willing to pay. Keep clear of the other kind, but never undertake to fight them. B.

WEIGHT OF FLOUR IN TIERS.

PROVIDENCE, January 21, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — In response to Mr. Kidder's inquiries, as to weight of material, I would say that flour in barrels, on their side, weigh forty-four pounds per square foot for each tier. Yours truly, A. S.

NOTES AND CLIPPINGS

STEADYING CHIMNEYS BY LOADING.— Mr. A. Hollenberg contributes to the *Zeitschrift* of the German Society of Engineers, an article upon the prevention or diminution of oscillation in chimney-stacks and high walls, by loading with an excess of dead weight. He cites an instance of a chimney only fifty-six feet high, built in common lime mortar, which, when completed, was observed to oscillate to an alarming degree. Consequently the chimney was loaded by putting on the top an iron plate weighing upward of two-and-one-half cwt. The cure was perfect. Although the stack is built in an exposed situation, it has stood for sixteen years, during which many severe storms have tried its strength, yet it does not show any horizontal or vertical cracks. Similar results are recorded in connection with the construction of a mill at Müllfort, near Rheydt. Here a mill-owner found it necessary to heighten a building by two stories, without interrupting work in the factory below. The constant vibration caused by the machinery, however, destroyed the walls as soon as the bricks were laid. To check this effect the walls were heavily loaded with iron rails as fast as the cement would bear them; and by this means the additional height was safely reached, the vibration of the walls being completely stopped. Heavy stone and iron curbs for chimneys are not so generally placed upon chimney tops as formerly. It is commonly thought that these finishing touches were intended for ornament only; but, according to the foregoing statements, there may have been more reason for them than has been generally supposed.

CEDAR FOR BREWER'S VATS.— The New York correspondent of the *Northwestern Lumberman*, writing of the cedar of the celebrated Dismal Swamp, says that years ago it was brought to the attention of brewers, and now the tanks and vats in these establishments are constructed almost exclusively of this material. Over 1,000,000 feet are now consumed annually in this line in New York City and its vicinity. As there is no tannic acid or resin in the wood it is peculiarly adapted for such a purpose. Long-continued experiments, with different woods, has proved that white cedar is the best. Oak abounds in tannic acid, and pine with resin. It has also been found that cedar has a wonderful durability. Growing in swampy districts, it seems inured to the effects of moisture, and will last for an incredible period without developing any tendency to warp or open. Tanks have been in use thirty years, and remain as good as ever. It has been used in this country for many years, but is now finding its way to Europe, and during the past year something like 100,000 feet have been sent to England for vats. The conservative brewers of the old country have been slow to test the worth of this wood, but when they do a brief trial is sufficient, and the cedar is adopted. A recent controversy in the European journals in regard to wood for vats and tanks has brought it more prominently than ever to the front on that side of the water, and it will most likely be more extensively used. There being but little waste in its manufacture, it can be sold at a much less price than pine tub plank. The price here has been $35 a thousand for the ordinary lengths and dimensions. Tanks and vats are constructed of various dimensions from 8 to 25 feet in height, so that the wood is cut in even lengths, 8, 10, 12 feet and so on up to the length required. Special lengths are made for special cases, and these come mostly in odd numbers. A lot was got out a few months ago 11 feet long. The logs were cut especially for it. Ordinarily the length is not over 20 feet. The thickness is 2, 2½, and 3 inches, and the width 6 to 8 inches. In small tanks the 2-inch material is used, and less than 6 inches wide is all right. For the large ones 3 inches and the larger widths are used. There is an order in now for 17,000 feet of 3-inch stuff for a tank 25 feet high. Lumber was recently furnished for a New York City brewery for a 20-foot vat requiring 60,000 feet.

A TIDE-WATER PUMP. — When Balboa discovered the Pacific he stood knee-deep in the placid waters at Panama, and the name given the great ocean was appropriate to the locality. As far north as California, however, it is a misnomer, for the waves of that ocean are there large all the summer, owing to the prevailing strong winds, and the winter storms off shore and near shore create large rollers constantly. It is now proposed to utilize this movement of the sea along that coast Interesting experiments are being carried on at the beach near San Francisco, north of the Cliff House, with that view, it being the ultimate object to supply the city with some fifty thousand or sixty thousand horse-power for industrial purposes, water being used instead of steam. The experiments are being carried out by a local engineer. The idea is to raise sea-water through the medium of a pump operated by the waves, to a height of about 350 feet, whence it can be directed into the city and the power used for elevators, mills, manufactories, etc. The apparatus used is described as exceedingly simple. A bridge has been built across a chasm into which the waves roll, and from the bridge is suspended a strong frame carrying a swinging-arm or lever, the lower end of which carries a float or paddle immersed in the water.

[1] "*Monographs of American Architecture,* IV. — *The Memorial Hall, Harvard College,*" Cambridge, Mass. Messrs. Ware & Van Brunt, Architects. Boston: Ticknor & Co., 1886. Price $5.00.

This lever or arm has its upper end suitably connected by rods that extend to a heavy crosshead. The lever is thirty-two feet long. The crosshead is connected with the plunger of a pump of twelve inches diameter and thirteen feet stroke. The pump is twenty-four feet above low-water level. As the lower arm of the lever moves to and fro with the action of the waves, it operates the pump, drawing the water from the sea and forcing it to the reservoir on the hill. The float on the submerged end of the lever is intended to be only about one foot under water. It is not placed in the long rollers, but works in the water inside the first line of breakers, so that it obtains the force which dashes the waves against the rocks. The operating-lever swings on the arc of a circle and can readily be withdrawn from the water as occasion demands, the power required to do this being furnished by a water-wheel. It is intended, provided the experiments are satisfactory, to establish a line of these pumps and levers. Other pumps of sixteen or seventeen feet stroke will be put up. Full stroke is seldom taken, the great length being given to provide for emergencies, so as not to break the pumps. At present the latter are pumping through pressure-valve and meter to determine the power. The force of the waves to the square foot is very large, and those engaged in the enterprise are of opinion that storm waves will not seriously affect the motion. The high tides are said to make no difference either. The pumps, it may be stated, are placed horizontally.— *Boston Transcript.*

HERR KRUPP'S WEALTH. — The official income-tax returns just published show that the man who is rated highest in all Prussia is Herr Krupp, of Essen, His income is assessed at more than 5,000,000 marks, or £250,000, on which he pays 151,200 marks, or £7,560 annually Next comes Baron Rothschild, of Frankfort-on-the-Main, with an income of 2,750,000, paying a tax of 81,000 marks, or £4,050 per annum. Then follows the British Consul-general, Baron Bleichröder, of Berlin, with an income of about 2,340,000 marks, paying an annual tax of 68,400 marks, or £3,420. The two next richest men in Prussia are two Silesian ironmasters. The only other Prussians with an income of over 1,000,000 marks are Baron Hausemann and a Westphalian magnate, each of whom pays rather more than £1,500 a year to the treasury. — *London Daily Telegraph.*

A REMARKABLE DOG STORY.— John Templeton is a blacksmith who owns a fine specimen of the English mastiff. Last week Mr. Templeton was working at his forge, putting a new steel in a pick. The new steel was slightly burned in the heating, and, instead of welding, flew in half a dozen pieces. One piece struck the blacksmith just above the right eye with such force as to fasten itself in firmly. The blacksmith staggered and fell backward. How long he was unconscious he does not know, but when he revived the dog lay almost in the middle of the shop crying almost like a human being, and rubbing his jaws in the dust of the floor. The piece of steel that had struck Mr. Templeton lay a short distance from the dog. The faithful brute had seized the hot steel with his teeth and drawn it from the frontal bone of Mr. Templeton's head. The dog's mouth was found to be badly burned. — *Albany Journal.*

DIVERTING THE OXUS TO THE CASPIAN. — The Tiflis authorities are much interested just now in the question of diverting the Oxus to the Caspian, an idea of Peter the Great, which has often been recommended of late years, but without entering upon a practical stage until recently. In the present form of the project it is proposed to cut the bank of the Oxus near the new railway station at Chardjui, and carry the water through a series of old river cuttings, across the Transcaspian desert to Balkan Bay. The advocates of the scheme state that it would be possible to do this without impairing the water supply at Khiva, whose very existence depends upon the irrigation-canals running out from the Oxus; and, moreover, in sufficient volume to enable the waterway to be navigated by steamers. The official newspaper *Kavkaz* has taken up the idea warmly, and published numerous articles, based on the latest surveys in support of it. The adverse decision of a commission appointed some years ago, when the idea of diverting the Oxus just above Khiva was mooted, does not, according to its view, affect the present issue. That commission traversed ground quite different from that at present contemplated, and which, moreover, was handicapped by the depression of the Sari Kamish, into which the commission reported the Oxus would flow without filling it up, and simply create another Aral Sea closer to the Caspian. In the present instance the construction of the railway from the Caspian to the Oxus has furnished a series of levels throughout, demonstrating that south of the watershed, between Sari Kamish and the railway, the ground is most favorably adapted for a waterway. Associated with the project is the construction of intermediate oases, for the cultivation of cotton, and the establishment of storage-reservoirs for water. In the autumn there are heavy falls of rain, and in the spring abundance of water from melted snow, both of which are at present allowed to disappear in the sands. By improving upon the methods of storage long in use among the Turcomans, it would be possible to form a large area of cultivated territory which, in time, would increase still further with the growth of vegetation, sheltering the fields and the reservoirs from the rays of the summer sun. In this manner the success of the waterway would not be dependent upon shipping only. Even if the scheme failed in this respect, it would be successful in opening up to cultivation large stretches of fertile clayey soil, which are simply deserts to-day, because there is no water to irrigate them in summer.— *Engineering.*

CONNECTICUT LAVA BEDS. — The repeated earthquake-shocks in the Western States, considered in connection with the destructively severe ones last August and September, make one wonder sometimes if Connecticut will always escape with as light a shaking up as it received when the city of Charleston was so nearly destroyed. But if there is no present danger from earthquakes and volcanic eruptions in Connecticut, the time is not so very distant, geologically speaking, when the city of Hartford, had it existed, would have been in danger of being flooded with lava. It was some time before the Connecticut Valley was peopled with red men, and about the time it was settled with red mud; it was when those great birds, thirty or forty feet high, and weighing 800 to 1,000 pounds, were stalking about in the mud at Portland, that a great rent was made in the crust of the earth up and down the Connecticut Valley, and streams of lava poured out. One of these fissures made its appearance within a few miles of Hartford, at Talcott Mountain, and the cooled lava now forms the solid foundation of that pleasant summer resort. Another outpour occurred near Meriden, and the cliffs there are what remains of this solidified ebullition after the glaciers have acted upon it. The east and west rocks of New Haven are the outcome of this same eruption, and just over the line Mount Tom and Mount Holyoke belong to the same family of fiery mountains, as also do the Palisades on the Hudson. It would appear that these lava eruptions in Connecticut were of comparatively short duration, and that the force that caused the earth to crack open up and down the valley in nearly a straight line, suddenly ceased to act and the fissures closed up again. Great as must have been the forces exerted, and vast as must have been the amount of lava forced out, yet these mountains of melted rock, here in Connecticut sink into insignificance when compared with a bed of lava in the northwestern part of this country. There the sheet of lava spreads out over the country from 2,000 to 4,000 feet thick. It covers not only the whole of Idaho, but most of Oregon and Washington Territory, and portions of Nevada, California, and Montana. Incredible as it almost seems, this great sheet, so many feet thick, spreads over an area of country nearly forty times as large as the whole State of Connecticut. All the Grand Army people who returned from California last fall, over the Northern Pacific Railroad, passed through a cañon several thousand feet deep, worn through this frozen sea of lava by the Columbia River. Much as Connecticut has to boast of, in owning some of the first dry land that was ever created, and which has since never been covered by water, and settled and solid as it now appears, covered with a coating of snow and ice, still in comparatively modern times it was in a very unsettled condition and on the point of boiling over its borders.— *Hartford Evening Post.*

TRADE SURVEYS

THE productive agencies of the country will be very fully engaged from the beginning to the close of the season. Prices have come to a halt in their upward course. Stocks of merchandise and material are moderate. Orders are crowding in for future attention. Manufacturers and jobbers are entering into engagements conditionally, *i.e.*, prices to be fixed at or near date of delivery. Coal, iron, steel, lumber, petroleum, tools, engines, building-material, are all firm in price. Prices, comparing figures for five years past, have been steadily declining. Anthracite coal, 22 per cent at competative points; lumber, 10 per cent; building-material 5 to 10 per cent. Iron and steel have advanced, within six months, from 10 to 50 per cent, steel rails representing the latter advance. Engines and boilers and tools and shop and mill equipments remain where they have been, except for patented improvements and modifications. The facts presented by the various industries do not admit of easy tabulation, and therefore conclusions suitable to one or two or more do not apply to all. The most unexpected is most likely to happen. Had it been foreseen, six months ago, that the enormous production of the past few months would take place, predictions of depression, over-production, and demoralized prices would have been accepted. On every hand production has been expanded. Locomotive making from a 1,500 basis to 2,000. Car-building has been increased fully 33 per cent. Iron-making has been increased 8,000 tons crude per week since January 1, and rolling-capacity is being expanded as fast as overcrowded foundries can turn out rolls. Bessemer capacity has been increased at the rate of 15 to 20 within six months, and so all through. The carriage and wagon makers have been, and now are, heavy buyers of lumber, steel, etc. The tool and agricultural-implement manufacturers have rushed in orders for material which, for some kinds, will last until July 1. Building-material is steady. Bricks may possibly advance, as it is given out that the supply at some points, viz., New York, Philadelphia and Chicago, will run short. This is altogether speculative. The stocks are very low and the prospective demand certainly heavy and sufficient to stimulate the most active efforts. Employers are making rapid progress in organization. They are presenting a bolder front to labor than they did or could last year. The leaders who see the disastrous termination of strikes have very sensibly been calling a halt, and are advising efforts of a different nature. Organized labor is looking this week to the National Labor Convention of Cincinnati where thirteen different factions have been endeavoring to mould into shape a political movement that may unite the producing interests, as they term themselves. The old greenback element predominates. This movement will act as a safety-valve to discontented labor. Wages will remain substantially where they were. Slight modifications will be made in this and that craft. The boot and shoe employers are slowly gaining vantage ground. The textile employers have held their ground well. The mill-owners in the Middle and Western States are practically free of danger from strikes. Shop-labor will prove docile. Mining-labor has effected agreements throughout the West which will avert strikes, and in the Eastern bituminous fields a 5 per cent advance will be offered, and probably accepted. From the commercial standpoint the country is in excellent condition. The railroad managers are hastening, with commendable activity, to place themselves and their rates in accord with the provisions of the new law governing rates of transportation. Just now considerable business is in suspense until freight rates are declared. Trade combinations continue to multiply for the purpose of controlling production and maintaining prices, but these combinations, while threatening much accomplish little. Financially the country is strong The supply of currency is adequate. A slight accumulation of money showed itself lately in Boston, New York and Philadelphia, but with the reëstablishment of confidence in uninterrupted industrial activity, it will reënter the channels of trade. Small manufacturing enterprises are multiplying everywhere on the solid basis of cash earned, and not on the dangerous basis of credit. Extraordinary purchases of real estate continue to be made by long-headed investors who see that, at the present rapid rate of expansion, new territory will be in urgent demand to engage the labor, skill and enterprise of the millions who are seeking broader opportunities.

The American Architect and Building News.

Vol. XXI. Copyright, 1887, by Ticknor & Company, Boston, Mass. No. 584

MARCH 5, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

WE are able, by the kindness of the gentlemen concerned, to give some interesting particulars in regard to the case of an architect's claim for compensation for work which he was engaged to do, but was prevented by the other party from doing, which was decided at Albany not long ago. The architect, or rather, the firm in question, was employed tö prepare sketches, in accordance with certain instructions, for a house to cost something less than seventeen thousand dollars. This work was done, and the sketches submitted and approved, and an order given to prepare working-drawings, specifications and details, and procure estimates for the work. Two days later notice was sent by the client to proceed no further with the work, but to send a bill for what had already been done. The architects replied that they should insist upon the fulfilment of the agreement by which they were employed to complete their services as far as the procuring of estimates, and would claim compensation for any damages which they might suffer from their abrupt dismissal; and, as their estimate of the value to them of the work done, and the damage which they incurred by the non-fulfilment of the agreement, they presented a claim for five hundred and fifty dollars. The referee found from the evidence that the architects had been employed, as they claimed, to prepare working-drawings, specifications and details, besides the sketches which they had already made, and to obtain estimates; and that they were ready and willing to do so, but were prevented by their client. He found also that the value of their services in making the sketches was one per cent on the proposed cost of the building, and that the value of their services in making working plans, specifications and details, and in obtaining estimates, would have been two and one-half per cent on the estimated cost; and he found also that out of this two and one-half per cent the architects would have had to pay about one per cent for expenses, which they saved by not actually doing the work; so that the net profits of the architects, or, as we should rather say, the value of their own services in doing the work for which they were employed, exclusive of the sketches, would have been two hundred and fifty dollars. Under the rule which governs in mercantile cases, he who violates a contract is liable for all the direct and proximate damages which result from such violation; and the true measure of damages is held to be the profits under the contract which would remain after deducting the actual cost of performing it; and the referee saw no reason why the same rule should not prevail in regard to the employment of architects; and judgment was therefore given for four hundred and seventeen dollars and fifty cents, this being three and one-half per cent on the proposed cost of the building, less the estimated expense to the architects of making the working-drawings, specifications and details, and obtaining estimates.

MR. LEWIS H. WILLIAMS, the New York contractor who transgressed the principles of trades-unionism by paying his men what they were worth, and by giving them a share in the profits of his business, has been savagely persecuted ever since by the union authorities. Finding that his men preferred a good income, and hope for the future, to slavery and the precarious living of people whose daily bread may be taken from them at any moment by the whim of a walking-delegate, they tried to break up the pleasant and confidential relations existing between the contractor and his employés by ordering those of the latter who were members of the union to quit their work. One or two of the nervous ones, remembering the terrible weapons which the secret committees of the unions can use against those who disobey them. followed the delegate's call, and left their work, but soon plucked up courage to return again, in defiance of the threats of their would-be masters. Finding the persons immediately concerned thus contumacious, the union officials proceeded to attack Mr. Williams by means of the vile conspiracies to which they have accustomed the public. Through the agency of the Central Labor Union, all framers, bricklayers and other mechanics engaged in building trades were forbidden to do any work whatever in buildings where Mr. Williams had contracted for the carpenter-work. With the help of this sort of proscription, more ruinous in its effects on a contractor's business than a papal excommunication would be to his spiritual comfort, the delegates believed that their victim would be brought to terms, and they congratulated themselves on having got the better even of his determination. Mr. Williams, however, although one of the quietest of men, possesses a resolution which those who have tried it most severely can best understand, and some six weeks have passed since the whole power of the building trades was put forth against him, without the appearance of any sign of surrender on his part. Although he must himself bear the principal losses which the trades will inflict upon him, he has been at least somewhat cheered by the cordial and sincere sympathy of the men who will suffer with him. A few days ago, they contributed out of the small income which their brethren, under the lead of a few revengeful delegates, are trying so successfully to reduce, about three hundred dollars, which they invested in a handsome testimonial, consisting of a portrait of Mr. Williams, executed in India ink, with an inscription expressing "the warm personal esteem" and the "very high appreciation" of the carpenters in his employ, not only on account of "his kind and liberal demeanor toward them," but for "his earnest and effective efforts for the general advancement of the moral and physical condition of his employés, furnishing an example eminently worthy the emulation of all the employers of the land." Such a testimonial as this, coming, not after a period of prosperity and general self-congratulation, but in a time of severe disappointment and adversity, is about as precious a possession as a man could well have; and if the unions should rob Mr. Williams of his last cent, they cannot take away from him the consciousness, which he will value more than a fortune, of having succeeded in inspiring those of his fellow men who depended most upon him with such true gratitude and affection.

M. ALFRED RENOUARD, the Secretary of the Northern Industrial Society of France, has made a study of the French laws relating to hours of employment, which promises to be of great service to persons interested in the amelioration of the condition of working people, particularly as he accompanies his statements of fact with some very suggestive comments. The immediate occasion of the publication of his notes is the demand which has been lately made that the Government shall, by decree, limit the number of working hours in the day; some reformers arguing that eleven hours should be the maximum number, while others prefer ten, and the anarchist section of the Workingmen's Congress, held last summer in Paris, pronounced itself in favor of eight hours. The present law in France, which restricts the working day to twelve hours, dates from 1848, and has a somewhat curious history. So long ago as 1776, many reforms were made in the laws relating to labor; the privileges of the trade corporations were abolished, and the practice of the manual arts thrown open to all who could attain the necessary skill in them. At the same time, the question of restricting the number of working hours was considered, perhaps, as in our own day, in the light of the theory that if men worked fewer hours, their work would last longer, and more would be employed; but Turgot, the great minister of finance, put an end to the discussion, declaring that the privilege of laboring for himself and his family

was the most sacred and inviolable right that a man possessed, and that he did not consider himself, even as the king's minister, justified in meddling with it in any way. This declaration produced a strong impression, and it was not until 1841 that, through the effect of the serious industrial changes produced by the introduction of machinery, and the collection of great numbers of operatives in manufactories, complaints began to be made in regard to the sufferings of working people, which reached the ears of the Government, and a commission was sent to investigate the matter. The accumulated evidence, much of which was collected and effectively set forth in a book on the subject, by Adolphe Blanqui, showed that in many industries the operatives were greatly overworked, fourteen hours being, in some manufactories, the regular working day. The Government of Louis Philippe was quite ready to devise a remedy for this state of things, but, before anything was done, the Revolution of 1848 took place, and the victorious heroes of the barricades assumed the direction of public affairs. These, finding the papers in regard to the matter among the other unfinished business of the late Government, solved the difficulty by one of those happy inspirations which serve cheap politicians in place of common sense, and ordained that, as the health of certain working people had been injured by working fourteen hours a day, thenceforth no person should work more than ten hours a day in Paris, or eleven hours in the rural districts.

THIS decree was received with consternation by employers and employed alike. Certain manufactures could not be carried on at all with only ten hours attention a day; and many others, which were compelled at once to conform to the new law and meet the competition of the free English and German establishments, languished and died, and the workmen, thrown out of employment, filled the air with their complaints. The wiseacres of the barricade government had already experienced a second inspiration. They had established national workshops in Paris, carried on at the tax-payers' expense, in which the starving work-people should be employed, and in less than three months a hundred and six thousand operatives from the ruined provincial factories applied for work at the national establishments. The national workhouses could only receive a portion of them, and the rest, in despair, betook themselves to barricades and violence, from which they were themselves the worst sufferers. The Constituent Assembly, which by this time had succeeded the provisional government, took immediate action upon the matter which had become so important, and, after collecting the opinions of the Provincial Chamber of Commerce, as well as the local officials all over the country, decided to extend the legal working-day to twelve hours, making exception later, however, in favor of dye-houses, sugar manufactories, printing-offices, foundries, rolling-mills, glue and soap-factories and many other establishments, in which the hours of labor might be extended either indefinitely, or to the number of thirteen or fourteen.

IN practice, this law has now become almost a dead letter, through the number and variety of the legalized exceptions to it; and the efforts of the commissions, which, at rare intervals, have of late years been appointed to see whether it was observed, have been gradually turning to the collection of information in regard to the protection of children from overwork in factories, instead of the men to whom the original decree referred. As has been often observed, the improvement in the design and adjustment of machinery have now made it possible for children to do a great deal of the work which, forty years ago, could only be done by stronger persons, and the factories which were once exclusively occupied by men are now filled with girls, women and young children. As M. Renouard well says, the State, which should avoid interfering with the freedom of action of grown men, is exercising a perfectly legitimate function in defending the feeble and helpless against the tyranny of stronger persons who happen to be in a position to abuse their authority; and the laws for the industrial protection of women and children have of late years been made very stringent in France, and are executed with the vigor characteristic of statutes supported by a unanimous popular sentiment. Although the slavery of young people in factories was never so revolting in France as in England, children seven years old are said to have been kept at work sixteen and seventeen hours a day in the woollen mills of Elbeuf, and eighteen hours in the little silk-weaving shops of Lyons, until a statute was passed which repressed these abuses without mercy; and since then commissioners appointed for the purpose have kept close watch of all manufactories where young persons are employed, sixty-one thousand establishments, employing more than two hundred and forty thousand young girls and children, having been inspected in 1885. As the statute now stands, no child less than twelve years old is allowed to work in any factory whatever; no girl or woman of any age is allowed to work in a mine; no child can be employed in any shop for working horn, bone, pearl, celluloid or other substances which yield a deleterious dust or are liable to explosion, or in any manufactory of carbolic acid, chlorine, or other noxious chemicals; and no girl less than eighteen years old can work in rag-picking shops, which are, in the opinion of the inspectors, insufficiently ventilated. Children more than twelve years old are permitted to work at any of the occupations not entirely prohibited to them for time not exceeding twelve hours a day, provided they are given an interval of rest at noon; but no boy under sixteen, and no girl under twenty-one is allowed, under any circumstances to work in a factory after nine o'clock at night, or before five in the morning, or at any time on Sunday. In the interior of factories it is permitted to employ boys or girls over twelve years old to drag hand-carts or trucks, provided that the transportation is done on a level surface, and that the load, including the weight of the hand-cart or truck, does not exceed two hundred and twenty pounds; but no boy less than fourteen, and no girl less than sixteen, can draw trucks or hand-carts in the public street. In Austria and Switzerland, the working day consists of eleven hours, with certain exceptions, and in the latter country no child under fourteen can be employed in any factory, and no one under eighteen is allowed to work nights or Sundays.

A GREAT scheme, which has been studied for years by the persons interested, with the assistance of the best experts, has now been so far considered in detail as to warrant an application to the Legislature of the State chiefly concerned for authority to carry it out. This scheme is nothing less than a plan for bringing water from the Adirondack Mountains, by an aqueduct through the Hudson valley, to supply not only New York and Brooklyn, but the towns and cities along the river. If we are not mistaken, the credit of the completed plan is due to Mr. Fanning, the engineer consulted by the projectors, whose interesting book, describing the work to be done, is familiar to the profession. It is intended to take the supply from the head-waters of the Hudson River, just where the stream leaves the mountains, forming a reservoir by means of a dam, which will be three hundred and eighty-five feet above tide-water, and two hundred and twenty-five miles from New York. From this reservoir an open canal, sixty feet wide, and perhaps eighteen feet deep, will take a thousand million gallons of water a day, which will be enough to supply Troy, Albany, Hudson, Poughkeepsie, Yonkers and the other important cities on its course, with an ample surplus for New York, Brooklyn and the suburban towns. The cost of the undertaking is estimated at sixty million dollars, which is less than that of the aqueduct that supplies Vienna, and the capacity of the canal will be five times that of the Vienna aqueduct, while the Hudson conduit will have the advantage of being utilized by a large population along its route, who will not only be glad to have the pure mountain water, but will pay enough for it to swell materially the dividends of the private corporation which now asks permission to carry out the plan.

THERE is a good omen for the building business of the country in the collapse of all the great strikes which have been provoked over the country by the officials of the labor associations, who, apparently, had no object in view except to make a display to the world of their newly-acquired power. In New York seventy-five thousand men are said to have been thrown out of work at once, at the dictation of the leaders whom they had sworn a solemn oath to obey, but who, apparently knew as little as their victims, and cared a good deal less, about the cause which they professed to have undertaken to defend. It seems to us that it is quite time for the law to step in, to protect innocent persons from being ensnared by union rules into a blind servitude to men who, even if sincere, are not often capable of judicious leadership; and the imposing of oaths of any kind upon citizens by anything but the public authority might with great advantage be made a criminal offence.

EARLY SETTLER MEMORIALS.— VII.[1]

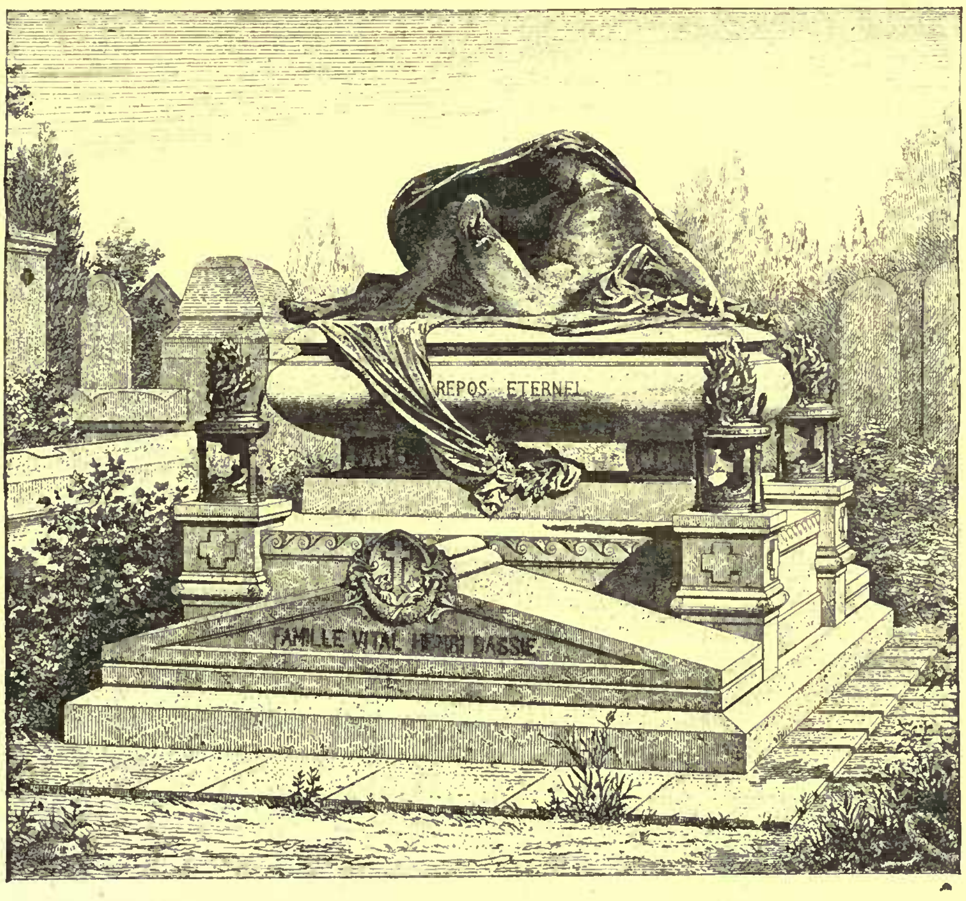
FIRST MONUMENT TO GENERAL JOSEPH WARREN.



Monument to Gen. Warren on Bunker Hill, 1794.

So far as we know, the earliest public monument erected to a revolutionary hero was that to the memory of General Joseph Warren. On the 14th of November, 1794, King Solomon's Lodge of Masons, of Charlestown, Mass., voted "that Brothers Josiah Bartlett, John Soley, Eliphalet Newell, William Calder and David Stearns be a committee to erect a monument in Mr. Russell's pasture (provided the land can be procured), such as, in their opinion, will do honor to the Lodge, in memory of our late brother, the Most Worshipful Joseph Warren; that they be authorized to draw upon the treasurer to defray the expenses of the same; and that when the monument is finished, they report their doings to the Lodge."

Honorable James Russell offered a deed of as much land as might be necessary for the purpose; and so active were the committee, and so earnest in carrying out the patriotic purpose for which they were appointed, that the next month (December, 1794) a special meeting of the Lodge was called to hear their report. They reported that they had erected a plain Tuscan pillar, built of wood, eighteen feet in height, exclusive of the pedestal, which was two feet high and eight feet square. This pedestal was afterward raised to eight feet in height, the better to protect the monument, and was built of brick and stone. The top terminated in a gilt urn, bearing General Warren's initials and age within the square and compasses. The whole was fenced around to protect it from injury. The total cost of the structure was, according to the committee's report and as stated in the records of the Lodge, not far from $500. But, according to the correspondence between the committee of the Lodge and the Bunker Hill Monument Association, in regard to placing a model of the original monument in the present structure, it appears that the total cost was not far from $1,000.



Tomb in the Cemetery at Bordeaux, France. M. A. Jouandot, Sculptor. M. Boussard, Architect.

The following inscription was placed upon the southwest side of the pedestal, engraved upon a tablet of plate, 16 x 26 inches:

ERECTED A. D. MDCCXCIV.
By King Solomon's Lodge of Freemasons,
Constituted at Charlestown, 1783,
In memory of
Maj.-Gen. JOSEPH WARREN
And his associates who were slain
On this memorable spot, June 17, 1775.

When the pedestal was raised to a height of eight feet, the following additional inscription was placed upon it:

"None but they who set a just value
upon the blessings of Liberty
are worthy to enjoy her."
"In vain we toiled; in vain we
fought; we bled in vain —
If you our offspring
Want valor to repel the assaults
of her invaders."
Charlestown settled 1628; burnt
1775; rebuilt 1776;
The enclosed land given
By Hon. James Russell.

[1] Continued from page 65, number 580.

The monument was dedicated with imposing ceremonies, December 2, 1794.

On March 8, 1825, a committee was appointed to make a present of the land and monument to the Bunker Hill Monument Association. Some time between this date and May 10, of the same year, the remains of the structure were demolished, for on that date it is recorded that a committee was appointed to investigate the matter.

When the original monument and the land were presented to the Monument Association, an assurance was given to the Lodge that some trace of the existence of the former structure should be preserved in the new monument. At first it was intended to place a marble tablet, suitably inscribed, in the interior of the present monument; but later this plan was changed, and it was decided to substitute a miniature model of the original monument. Accordingly, an exact model was constructed of the finest Italian marble. Including the granite pedestal on which it stands, it is about nine feet in height.

This model is placed on the floor of the inner chamber of the well room of the present obelisk, directly in front of the entrance. In addition to the original inscriptions, which had been faithfully copied, the following was engraved on the model:

"This is an exact model of the first monument erected on Bunker Hill, which, with the land on which it stood, was given, A. D. 1825, by King Solomon's Lodge of this town to the Bunker Hill Monument Association, that they might erect upon its site a more imposing structure. The Association, in fulfilment of a pledge at that time given, have allowed, in their imperishable obelisk, this model to be inserted, with appropriate ceremonies, by King Solomon's Lodge, June 24, A. D. 1845."

The anniversary of St. John the Baptist, June 24, 1845, was selected as the day on which "to commemorate this last offering to the memory of those who were slain on the ever memorable 17th of June, 1775."

The stone tablet upon which was inscribed the inscription of the old monument, and a section of the original shaft, are now in possession of King Solomon's Lodge.

THE WARREN STATUE.

The marble statue of General Warren, which stands in the building at the base of Bunker Hill Monument, originated in the suggestions of Col. T. H. Perkins, a public spirited citizen of Boston, in 1850. In a communication to the Bunker Hill Monument Association, of which he was a member, he offered to give a thousand dollars in aid of the project, and at the same time recommended for consideration Mr. Henry Dexter, of Cambridgeport, as a sculptor fully competent to undertake the work.

The committee appointed by the Association recommended that the subscription be opened for a statue, and that a memorial be addressed to Congress, praying that an appropriation in aid of it be made by way of executing the resolve of the Continental Congress, passed April 8, 1777. As this resolve contemplated the erection of "a monument to General Warren, in the town of Boston," it was thought advisable, in order to secure the appropriation from Congress, to propose that the statue should be placed in Faneuil Hall, should the City Government of Boston consent to receive it.

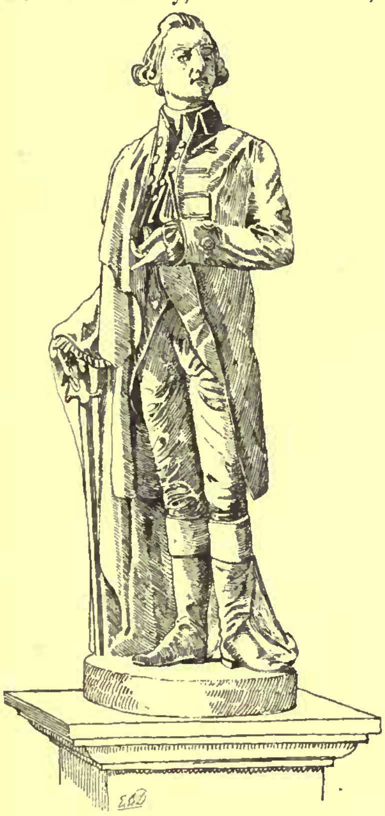
The memorial was presented to Congress in 1850, and re-presented for several successive years, but with no report upon the subject. The committee therefore decided, in 1854, to carry on the work by private effort, and accepted Colonel Perkins's suggestion by commissioning Mr. Dexter to execute the work. They also decided to place the statue on Bunker Hill, as Congress had failed to discharge the honorary obligation imposed upon it by the resolve of 1777. A temporary building was accordingly erected, near the monument, and the statue unveiled on the 17th of June, 1857. It is of white Italian marble, seven feet high, and cost five thousand and fifty dollars. It

stands upon a pedestal of Vermont verd antique marble, presented by the heirs of Dr. John C. Warren, of Boston.

The ceremonies attending the inauguration of the statue and the celebration of the eighty-second anniversary of the battle of Bunker Hill, were of the most imposing military and civic character. Edward Everett delivered the address of presentation of the statue, George Washington Warren the address of reception, and John T. Heard, the Grand Master of the Grand Lodge of Masons, the address of inauguration. Among the soldiers present was Benjamin Smith, a veteran of ninety-four years, who was a fifer for three years in the Revolutionary War. Mr. Everett, in his address, spoke of the sculptor as "a meritorious and self-taught American artist;" and of the statue, that it would be alike superfluous and indelicate to enlarge upon its merits in the presence of its sculptor and that of his work — a commendable piece of self-restraint.

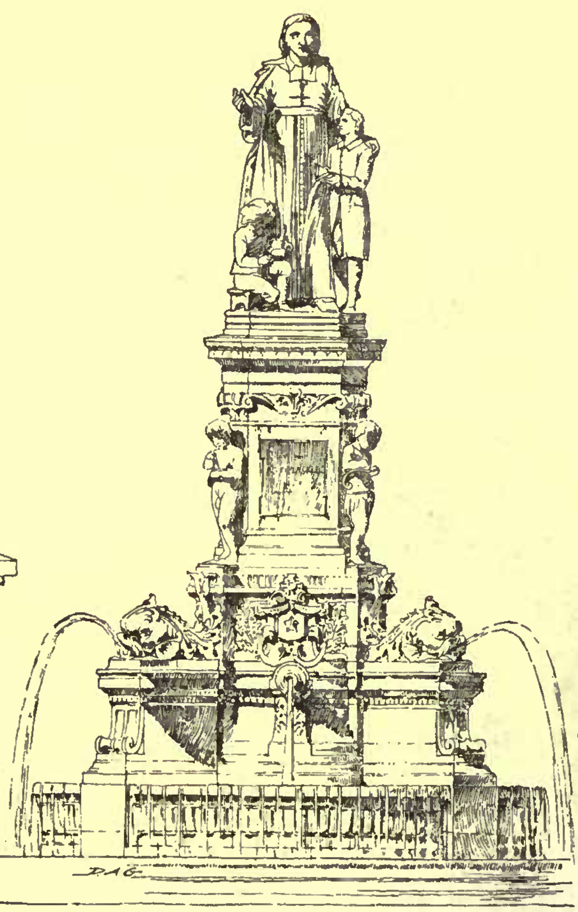
THE PROPOSED NEW MONUMENT TO WARREN.

The Joseph Warren Monument Association was chartered by the State of Massachusetts in 1873. The site for the proposed structure is a triangular piece of ground, opposite the stone house belonging to the Warren family, on Warren Street, Boston. The house occupies



The Warren Statue Henry Dexter, Sculptor.

the site of General Warren's former residence. The ground was given by the City of Boston, and the committee on the monument have procured twenty bronze cannon from Congress, with which to make the statue. The selection of a design for the monument devolved upon Mr. L. Foster Morse, a well-known real-estate agent, who accepted the one made by Mr. Alfred A. Combe, of the Smith Granite Company, of Rhode Island.



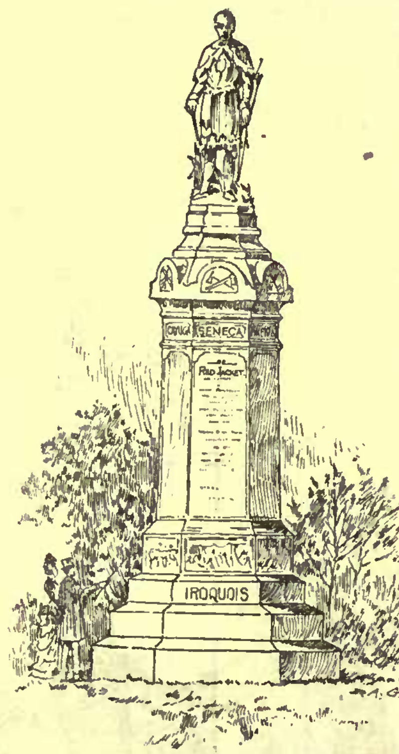
Monument to J. B. de la Salle et Rouen, France.

It is proposed that this company shall execute the work. The following amusingly exact yet utterly unintelligible description of the design, has been given to the public through the press:

"The monument will be thirty-four feet seven and one-half inches in height, and will cost twenty thousand dollars. The pedestal will be twelve by ten feet, and five feet in height; the plinth seven by five feet, and two feet in height; the shaft proper, three feet ten inches square at the top, and nine feet in height. This will be surmounted with scroll-work frieze, and a capstone four and one-half feet square. On this will be placed a statue of General Warren, in bronze, facing toward the head of Warren Street, the right arm uplifted and the left hand clasping a roll of parchment. The statue represents the General as wearing a loose cloak, thrown back from the right shoulder, and top-boots. There are to be on the four faces of the plinth, in low relief, the following inscriptions: Front, 'The Battle of Bunker Hill'; rear, 'In honor of Joseph Warren, major-general of Massachusetts Bay. He devoted his life to the liberties of his country, and in bravely defending them he fell, an early victim, in the battle of Bunker Hill, June 17, 1775.' On the side facing the site of the old Warren homestead, now occupied by the dwelling of Dr. A. H. Nichols, will be a representation of the old homestead; on the west side will be represented Warren as he appeared delivering his celebrated oration in the pulpit of the Old South Church on March 5, 1774."

Although subscriptions have been solicited from the public to help pay for this monument, the design has not been publicly exhibited, nor is it the intention of those having it in charge to exhibit it until the monument becomes an established fact.

In times past there has been a good many unsatisfactory proceedings connected with the erection of public monuments and statues in Boston, and the results have not been more satisfactory. This is the first time that a perfectly new and congruous programme has been laid out. No artist known to the public, as such, is connected with the project. The selection of a design is left to one person, who is also unknown as possessing the qualifications for fulfilling such an important trust; and the execution of the monument is given to a company without reputation as art producers. Withholding the design from public view is a fitting completion to the programme. No surprise has been expressed at the presentation of this scheme, though the question has been asked as to whether persons owning real estate in the immediate vicinity of the selected site were desirous of having forever before their eyes a structure of such doubtful antecedents. No greater reflection could be made upon the taste of



Proposed Monument to Red Jacket.

those most interested in the progress of monumental art in Boston than the entire character of this programme. A programme no higher, from an art point of view, than that which resulted in the Cogswell fountain.

The present Congress — 1885-86 — has been asked to carry out the Resolve of 1777 (before mentioned), and it is believed that ten thousand dollars will be received from that source, and it is proposed to raise, by subscription, fifteen thousand dollars.

MEMORIALS OF RED JACKET.

Red Jacket died in 1830, and on his death-bed said, in parting with his Christian wife: "When I am dead it will be noised about through all the world. They will hear of it across the waters and say, 'Red Jacket, the great orator, is dead.' Clothe me in my simplest dress, put on my leggins and my moccasins, and hang around my neck the cross I have worn so long, and let it lie upon my bosom; then bury me among my people. Your minister says the dead will rise. Perhaps they will. If they do, I wish to rise with my old comrades; I do not wish to rise with the pale faces; I wish to be surrounded by red men."

He was buried amid the graves of his brother chiefs, in the Seneca Mission burying-ground in East Buffalo, New York, a locality once occupied by an ancient Indian fort, and of which the lines of entrenchment could be distinctly seen as late as 1842.

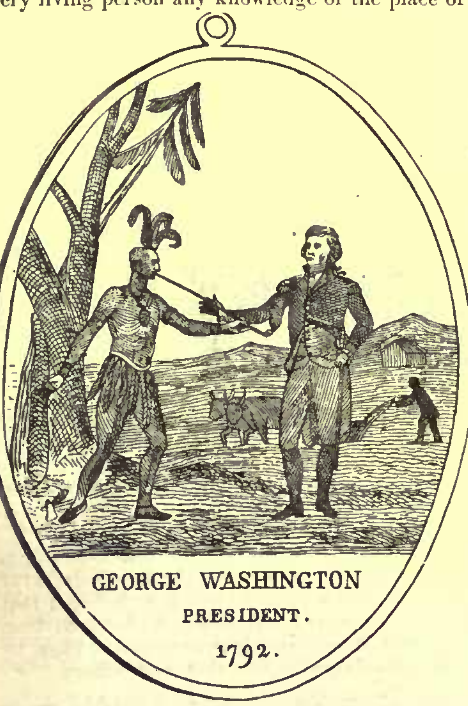
"A little to the north of the principal entrance was the grave of the celebrated chief, Red Jacket, so long the faithful friend and protector of his people against encroachments of the whites, and still, as we might imagine, the watchful sentinel, solemnly guarding this little spot, where so many of his chosen friends recline around him, from the desecrating touch of the race whom he had so much reason

to fear and hate. No stones mark the graves of these primitive nobles. In the summer of 1839, Henry Placide, the actor, while on a visit to Buffalo, determined that Red Jacket's grave should no longer remain undistinguished. A subscription was set on foot under his auspices, and the result was the erection of a handsome marble slab over his last resting place, bearing the following inscription:

SA-GO-YE-WA-THA,
(HE KEEPS THEM AWAKE)
RED JACKET.
CHIEF OF THE
WOLF TRIBE OF THE SENECAS.
THE FRIEND AND PROTECTOR OF HIS PEOPLE,
DIED JANUARY 20, 1830,
AGED 78 YEARS."

By 1852, this stone "had been chipped away to half of its original dimensions by relic hunters and other vandals. The cemetery had become the pasture ground for vagrant cattle, and was in a scandalous state of dilapidation and neglect." The legal title to the grounds had passed into the possession of a land company, though the Indians were led to believe that the church grounds and the cemetery were excluded from its operation. In the above year, "George Copway, the well-known Ojibwa lecturer, delivered two or more lectures in Buffalo, in the course of which he called attention to Red Jacket's neglected grave, and agitated the subject of the removal of his dust to a more secure place, and the erection of a suitable monument. A prominent business man, the late Wheeler Hotchkiss, who lived next the cemetery, became deeply interested in the project, and he, together with Copway, assisted by an undertaker named Farwell, exhumed the remains, and placed them in a new coffin, which was deposited with the bones in the cellar of Hotchkiss's residence."

The principal men of the few Senecas still living discovered that the old chief's grave had been violated, almost simultaneously with its accomplishment. Two of them, with a party of excited white sympathizers, repaired to Hotchkiss's residence, and demanded that the remains should be given up. The request was complied with, and the bones were taken to Cattaraugus, and placed in the custody of Ruth Stevenson, the favorite step-daughter of Red Jacket, and a sister of Daniel Two Guns, one of the Senecas who obtained the remains from Hotchkiss. Ruth preserved the remains in her cabin for some years, and finally buried them, but resolutely concealed from every living person any knowledge of the place of sepulture.



Silver Medal Presented to Red Jacket in 1792 by order of Gen. Washington.

"On the evening of the 29th of December, 1863, the late Chief Strong, by invitation of the Young Men's Christian Association, delivered a lecture in the city of Buffalo, the theme of which was Red Jacket. He concluded with an eloquent appeal, addressed to his white brethren, to rescue the remains of Red Jacket, and other eminent chiefs from threatened profanation, and bury them in Forest Lawn Cemetery. A few of the concluding sentences of the address were as follows:

"'I stand before you now in the last hours of a death-stricken people. A few summers ago our council-fires lighted up the arches of the primeval wood, which shadowed the spot where your city now stands. Its glades rang with the shouts of our hunters and the gleeful laugh of our maidens. The surface of yonder bay and river was seamed only by the feathery wake of our bark canoes. The smoke of our cabins curled skyward from slope and valley.

"'To-night! To-night! I address you as an alien in the land of my fathers. I have no nation, no country, and, I might say, I have no kindred. All that we loved, and prized, and cherished is yours. The land of the rushing river, the thundering cataract and the jewelled lakes are yours. All these broad blooming fields, those wooded hills and laughing valleys are yours — yours alone. There is one boon we would ask of you. Gather up tenderly the bones of Red Jacket, Corn-planter, Young King, Pollard and their brother chieftains, and bury them in yonder cemetery, where the plow of the husbandman will not invade their repose. There, in sight of their own beautiful river, and under the shadow of the trees they loved so much, our sachems will sleep well.

"'Within the limits of this city, the great orator once said, "But an evil day came upon us. Your forefathers crossed the great waters, and landed on this island. Their numbers were small. They found friends, not enemies. They told us that they had fled from their own country for fear of wicked men, and had come here to enjoy their religion. They asked for *a small seat*. We took pity on them, and granted their request, and they *sat down* amongst us. We gave them corn and wheat."

"'Brothers of the pale race: We crave now, in our turn, but 'a small seat' in yonder domain of the dead!'"

Although Strong's appeal deeply affected his audience, moving many of them to tears, the project was allowed to slumber until 1876, when Mr. William C. Bryant, a member of the Buffalo Historical Society, visited the Cattaraugus Reservation, and laid the matter before the Council of the Seneca Nation, which was then convened there. The assembled chiefs voted their unqualified approval of the project.

Ruth Stevenson, by reason of increasing age and anxiety in regard to the future of the bones of Red Jacket, finally delivered them into the custody of the Buffalo Historical Society, which, with the approval of the Council of the Seneca Nation, agreed to provide a permanent resting place for the old chief and his compatriots. The remains of Red Jacket were accordingly received from their aged custodian in 1879, and deposited in the vault of a bank, until their final sepulture in Forest Lawn Cemetery, in October, 1884.

What was left of the gravestone erected by Placide was placed in the rooms of the Historical Society.

In the spring of 1884, the Society made arrangements for the re-interment of the remains of Red Jacket, and those of other chiefs still resting in the Mission Cemetery. Five of the skeletons of the exhumed chiefs were identified as those of Young King, Destroy Town, Captain Pollard, Tall Peter and Little Billy. Several other skeletons were identified, and many could only be designated in the re-interment as the "undistinguished dead." The trustees of Forest Lawn generously gave to the Historical Society a large and conspicuous plot for the purpose of burial. A public subscription was solicited to cover the expenses of the Society incurred in the re-interment and the erection of a monument. It was generously responded to by the citizens of Buffalo.

The ceremony of re-interment, which took place on the 9th of October, 1884, under the auspices of the Society, was one of the most interesting, memorable, and singularly suggestive, in the history of the dead in this country. Rare indeed, is it, that any organization is so fortunate, can crown itself with so humane an honor, as that which will ever distinguish this Society. The procession from the rooms of the Society to the cemetery was witnessed by an immense crowd of people. The bones of Red Jacket, and those of five other chiefs were severally placed in a polished oak casket. The pall-bearers were Indians, and the services were conducted according to their custom. Thirty-six Indians, representing eight different tribes, took part in the ceremony. Dirges and chants were sung in Indian language, a wampum belt, that had been preserved by the Seneca Nation for over two hundred years, was displayed, and addresses were made by eminent pale faces and Indian chiefs.

Chief John Buck, the hereditary "keeper of the wampum belts," sang in long, low, mournful tones the following chant in the Onondaga language:

"Now listen, ye who establish the Great League,
Now it has become old —
Now there is nothing but wilderness,
Ye are in your graves who established it —
Ye have taken it with you, and have placed it under you.
And there is nothing left but a desert.
There you have taken your intellects with you,
What ye established ye have taken with you,
Ye have placed under your heads what ye established,
The Great League."

Then the other chiefs joined in the chorus as follows:

"Woe! Woe!
Hearken ye!
We are diminished!
Woe! Woe!
The clear land has become a thicket.
Woe! Woe!
The clear places are deserted.
Woe! Woe!
They are in their graves —
They who established it —
Woe!
The Great League.
Yet they declared,
It should endure —
The Great League.
Woe!
Their work has grown old.
Woe!
Thus we are become miserable."

On the evening of October 9 commemorative exercises were held in music, in the presence of three thousand people. The Society contemplates re-interring the tenants of graves in other neglected Indian burial grounds. The 8th of October was also notable from the fact that the first general council of the united Iroquois which had been held since the Revolutionary War, took place on that day.

It is generally believed by white men who heard Red Jacket speak

that he was the most eloquent of all Indian orators. He was noble in person, dignified in demeanor, and impressive in his voice and gesture. Though some of his tribe were Christians, he would have nothing to do with anything of the kind. His most famous speech was made at a council of Seneca chiefs and warriors, held in Buffalo, in 1805, assembled at the request of a missionary from Massachusetts, Mr. Cram. The missionary spoke first, saying the things that are usually uttered by Christian ministers to savages. After he had done speaking, the Indians conferred together about two hours, by themselves, when they gave an answer by Red Jacket. At the close of his speech he said, "As we are going to part, we will come and take you by the hand, and hope the Great Spirit will protect you on your journey, and return you safe to your friends." When the Indians drew near to take the missionary by the hand, he would not receive them, telling them "that there was no fellowship between the religion of God and the works of the Devil, and, therefore, could not join hands with them." The Indians smiled and retired.

Red Jacket once said to a clergymen who was importuning him on the common participation in the guilt of the crucifixion, "Brother, if you white men murdered the Son of the Great Spirit, we Indians have nothing to do with it, and it is none of our affair. If he had come among us, we would not have killed him, we would have treated him well. You must make amends for that crime yourselves."

MONUMENT TO RED JACKET.

The proposed monument to Red Jacket and his brother chieftains was designed by Hon. Elias S. Hawley. It is in the form of a hexagon, one side for each of the six nations: Mohawks, Oneidas, Tuscaroras, Onondagas, Cayugas and Senecas. The pedestal will be thirty feet high, built of granite, and the statue of Red Jacket, in bronze, ten feet high. The base stone, immediately under the die, will have on each of its sides a bronze bas-relief representing a scene from Indian life — the chase, the council, the battle, wigwam scenes, etc., while the cap will be decorated with Indian ornaments, utensils and weapons of warfare. The estimated cost of the entire monument is ten thousand dollars. The first base has been put in its place, and a polished granite headstone marks the old chief's last resting-place. The inscription, written by the designer of the monument, is as follows: —

RED JACKET,
[SA-GO-YE-WA-THA]
THE
RESOLUTE CHAMPION
OF A WRONGED AND HAPLESS
PEOPLE,
THE INSPIRED ORATOR,
"THE RIENZI OF THE
IROQUOIS,"

DIED AT BUFFALO CREEK,
JANUARY 20, 1830.
AGED 78.

"When I am gone and my warnings no longer heeded, the craft and avarice of the white man will prevail. My heart fails me when I think of my people, so soon to be scattered and forgotten."

"Who, then, lives to mourn us?
None!"
"What marks our extermination?
Nothing!"

The quotations are Red Jacket's own words.

If the beautiful tribute paid to the memory of these famous sons of the forest by the Historical Society is a glory to be remembered and an honor to itself, the completing and far more significant event in its programme is the erection of the proposed monument. It is given to monuments to tell the most lasting and universal human story. They close the list of the great events of a people; they are the immortal mile-stones that carry to posterity the last breath of dead nations. "Show me your monuments and I will tell you what you are" is an expression whose authority history has never questioned. No more signal or completely representative subject for a monument can be found in the entire history of the red man than that which the society proposes to consider. It includes an unusually singular and impressive element, one that should be respectfully regarded, in the fact of Red Jacket's persistent isolation as a representative of a race that had no interests in common with its white destroyer. He expressed it with his last breath: —

"I wish to rise with my old comrades. I do not wish to rise with the pale faces; I wish to be surrounded by red men."

The idea of the proposed monument, a structure that rises into the air rather than spreading out on the ground, is a good one; but the way it is planned, as shown in the illustration, makes it in every way objectionable. The statue of the great sachem ought to be an important, if not dominating, part of the monument. As it is, it is ludicrously subordinate. To make such an Indian, with his positive and distinct phases of character, the meek displayer of a bow and tomahawk, is indeed pitiful. The short inscription is drawn out over a perpendicular distance of ten feet. There are too many words about the design. Illustrations alone, no matter what their subjects may be, do not make monuments. It is to be hoped that before the society proceeds with its purpose, it will give the subject of design more careful study. T. H. BARTLETT.

[To be continued.]

THE ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

A STREET IN BREMEN, GERMANY.

[Gelatine Print, issued only with the Imperial Edition.]

PARK AVENUE M. E. CHURCH, PHILADELPHIA, PA. MESSRS. HAZLEHURST & HUCKEL, ARCHITECTS, PHILADELPHIA, PA.

THE perspective shows the design awarded first premium in a competition for the new building of the Park Avenue M. E. Church. It has a frontage of eighty-five feet on Norris Street, and seventy-five feet on Park Avenue, connecting with the old chapel. The materials used are Trenton brown-stone, trimmed with Euclid stone; the roof is of slate, except tower and corner octagon, which are of red tile. The windows are subdivided by stone tracery. As shown on the plan, the seating has the amphitheatral arrangement, the floor pitching radially to the platform. The roof is open-timber construction, carried on four stone clustered columns. The walls will be tinted sand finish, and wainscotted in cherry. The organ and choir are in a recessed gallery over the platform. The floors of vestibules are to be tiled; ceilings panelled in wood. The building is to be thoroughly ventilated and heated by steam, indirect radiation. Work was begun last August, and the building will be completed in the summer of 1887. The cost will be $40,000.

HOUSE, RICHMOND, VA. MR. M. J. DIMMOCK, ARCHITECT, RICHMOND, VA.

THE house to be erected on Franklin Street. The lot is an interior one, and thirty feet front. Material, rock-face red sandstone for first story, and red brick above, with a blue slate roof; the interior finished in oak, walnut and native pine.

OLD COLONIAL WORK — DETAILS FROM KING'S CHAPEL, BOSTON, MASS. MEASURED AND DRAWN BY MR. F. E. WALLIS, BOSTON, MASS.

HOUSE AT FOX HILL, NEAR PHILADELPHIA, PA. MR. T. P. CHANDLER, JR., ARCHITECT, PHILADELPHIA, PA.

DESIGN FOR A COUNTRY HOUSE. MR. CHARLES EDWARDS, ARCHITECT, PATERSON, N. J.

DOORWAY AT CHARLIEU, FRANCE.

UNITED STATES GOVERNMENT BUILDING PRACTICE. — II.[1]

GENERAL CONDITIONS AND INSTRUCTIONS.



PROPOSALS must be made in a lump sum for furnishing all the labor and materials [here are enumerated the various items of work, and for what building] in accordance with the drawings and specifications.

Bids received after the time of opening will not be considered.

Parties obtaining the drawings must return them within [blank] days from the date of receipt. [When the copies of the drawings are limited the above clause is put in allowing as many days as are necessary for bidders to prepare their estimates, otherwise it is omitted.]

Samples and Time to complete.— Each bidder must submit, with his proposal, properly-marked samples of the materials which he proposes to use in performing the work; and must also state in his bid the time in which he proposes to complete the work. The quality of the materials and the time required will be considered in awarding the contract.

Payments.—Payments will be made monthly, deducting ten per cent of the value of the work executed, and retaining same until the completion and acceptance of the entire contract.

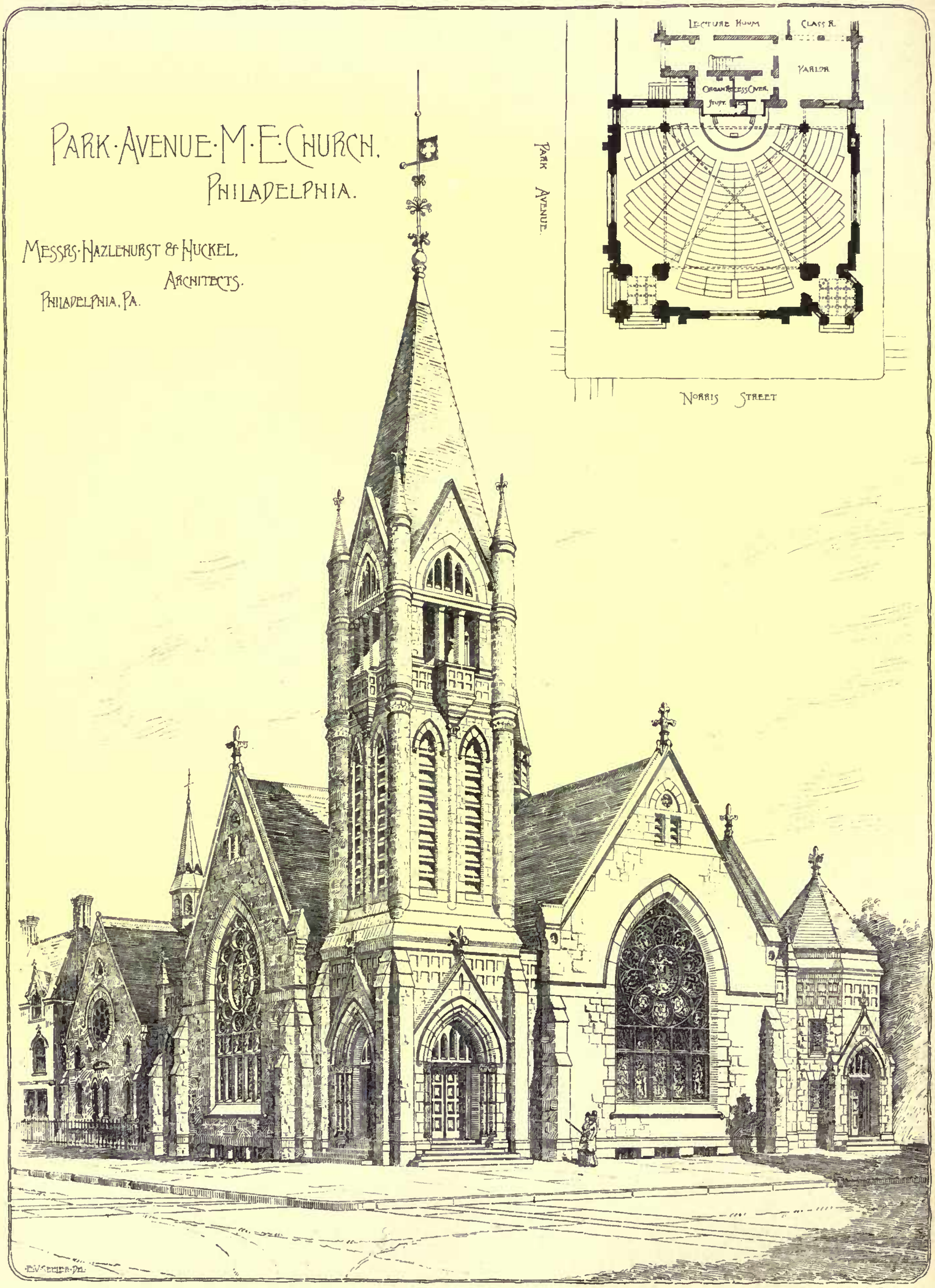
Certified Check.— All bids should be made on the blank form hereto attached, designed for the purpose, and to be obtained on application at this office or the office of the Superintendent of Construction, and must be accompanied by a certified check for the sum of $—— [the amount of the check varies, and is intended to reimburse the Government for any damage, in case the lowest bidder or contractor declines to perform the work], drawn to the order of the Treasurer of the United States, as security that the bidder will accept and perform the contract if awarded him, and (in case the United States shall so desire) will execute within two weeks from date of receipt of form a contract for said work, and give such bond for the faithful performance thereof as shall be satisfactory to the United States; the sufficiency of the sureties on such contract to be certified by the judge or clerk of the United States District Court, or the United States District Attorney for the district in which the bidder resides.

[1] Continued from page 67, No. 580.

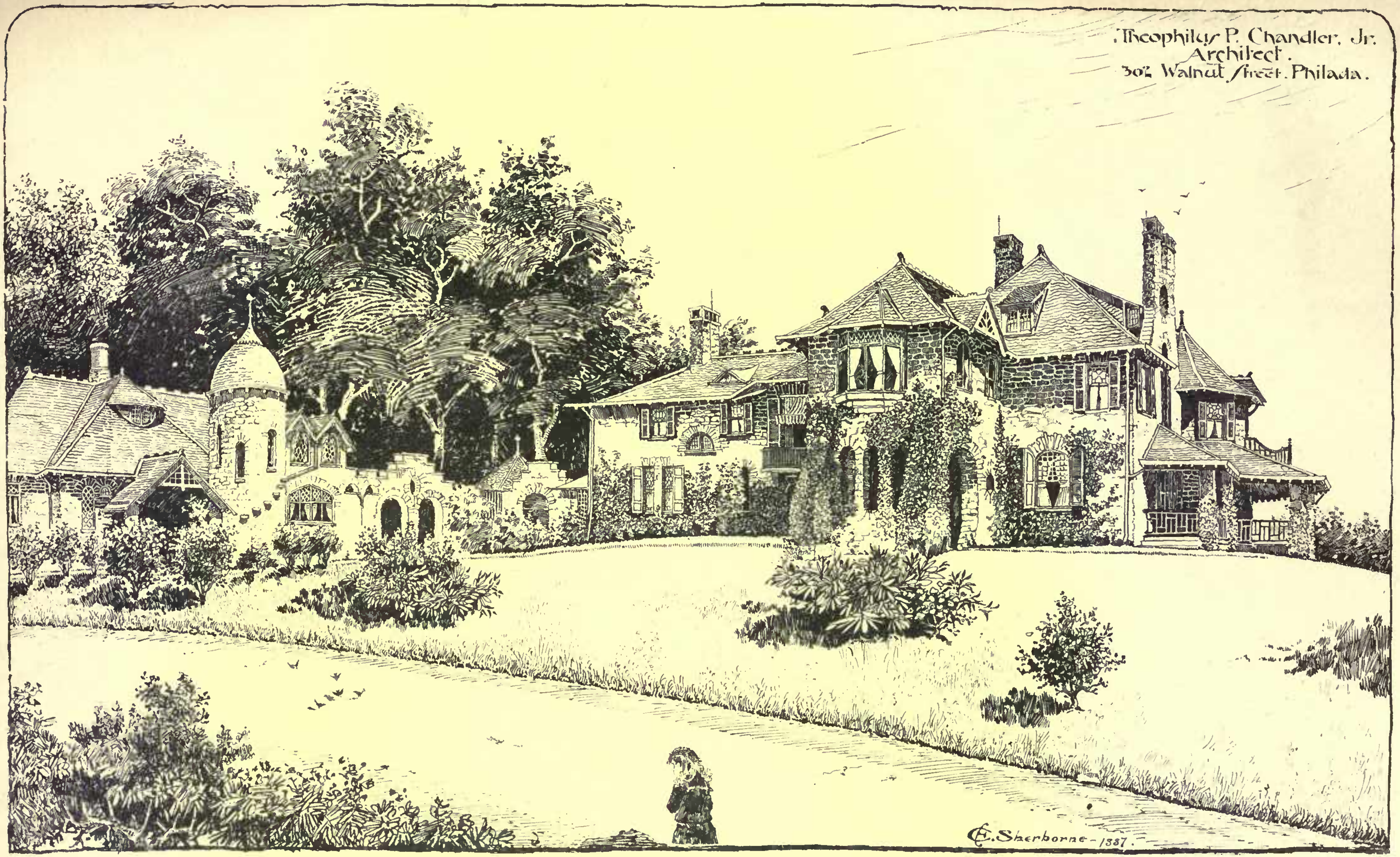


Heliotype Printing Co. Boston

Doorway at Charlieu, France.

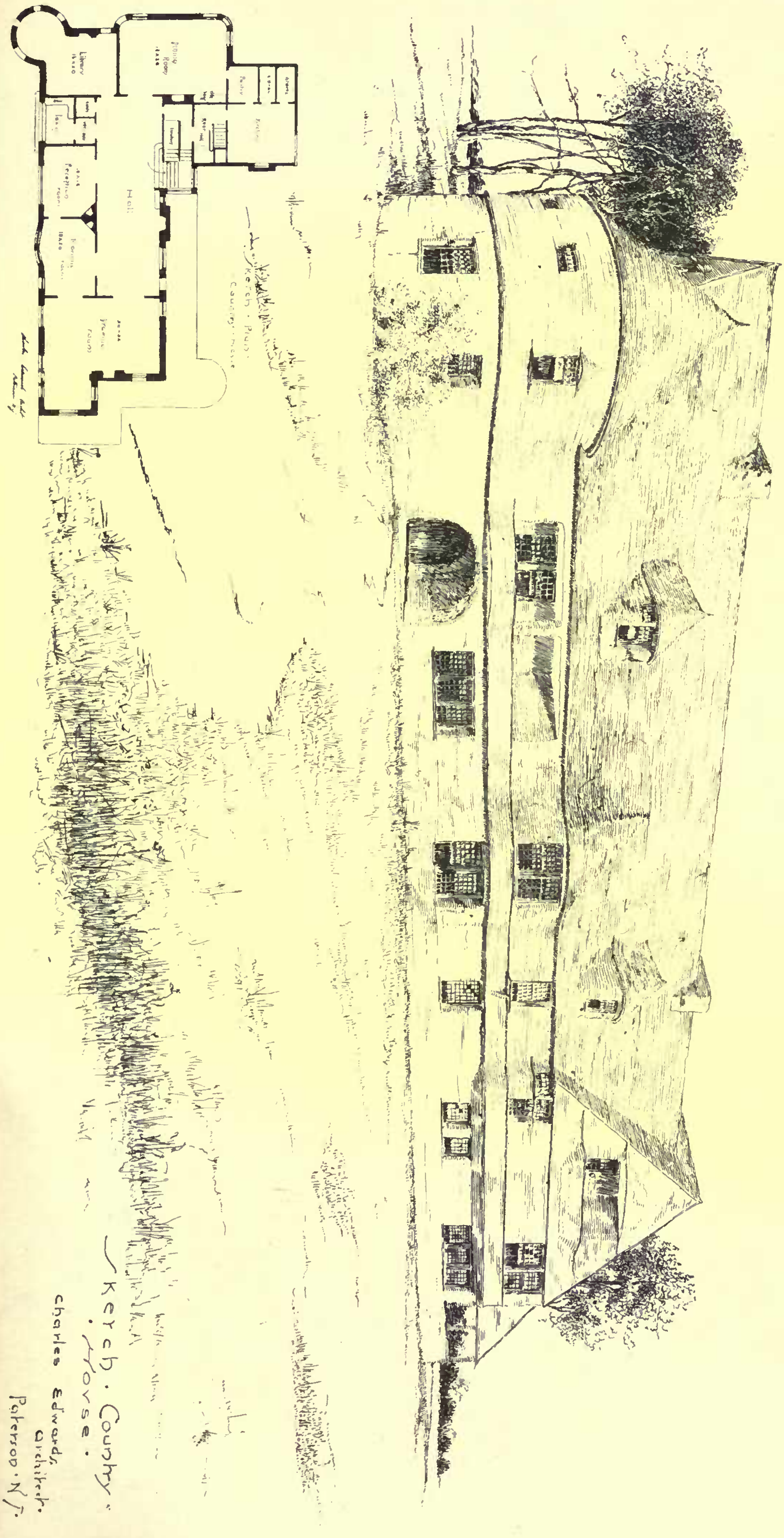


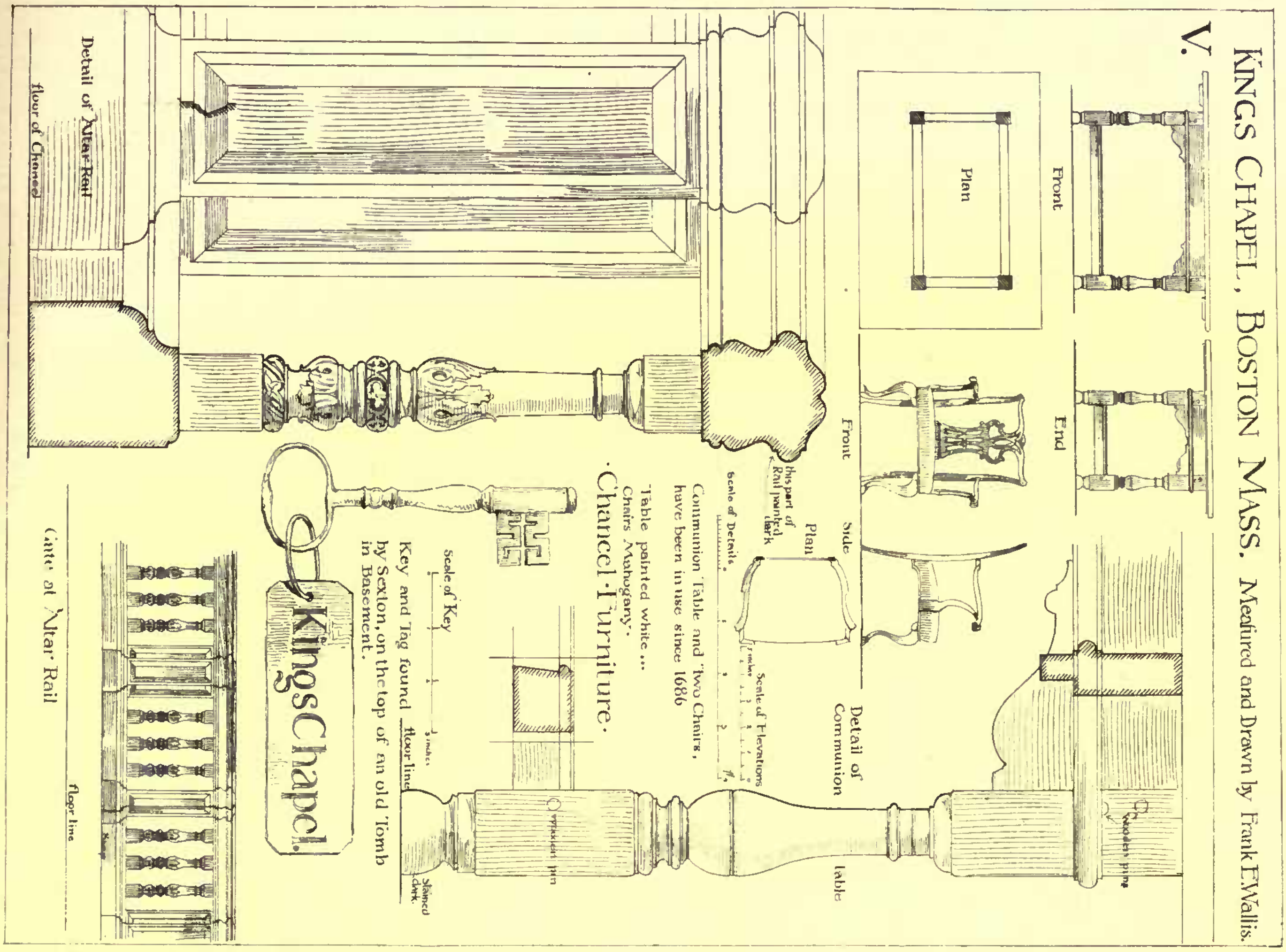
Heliotype Printing Co. Boston.

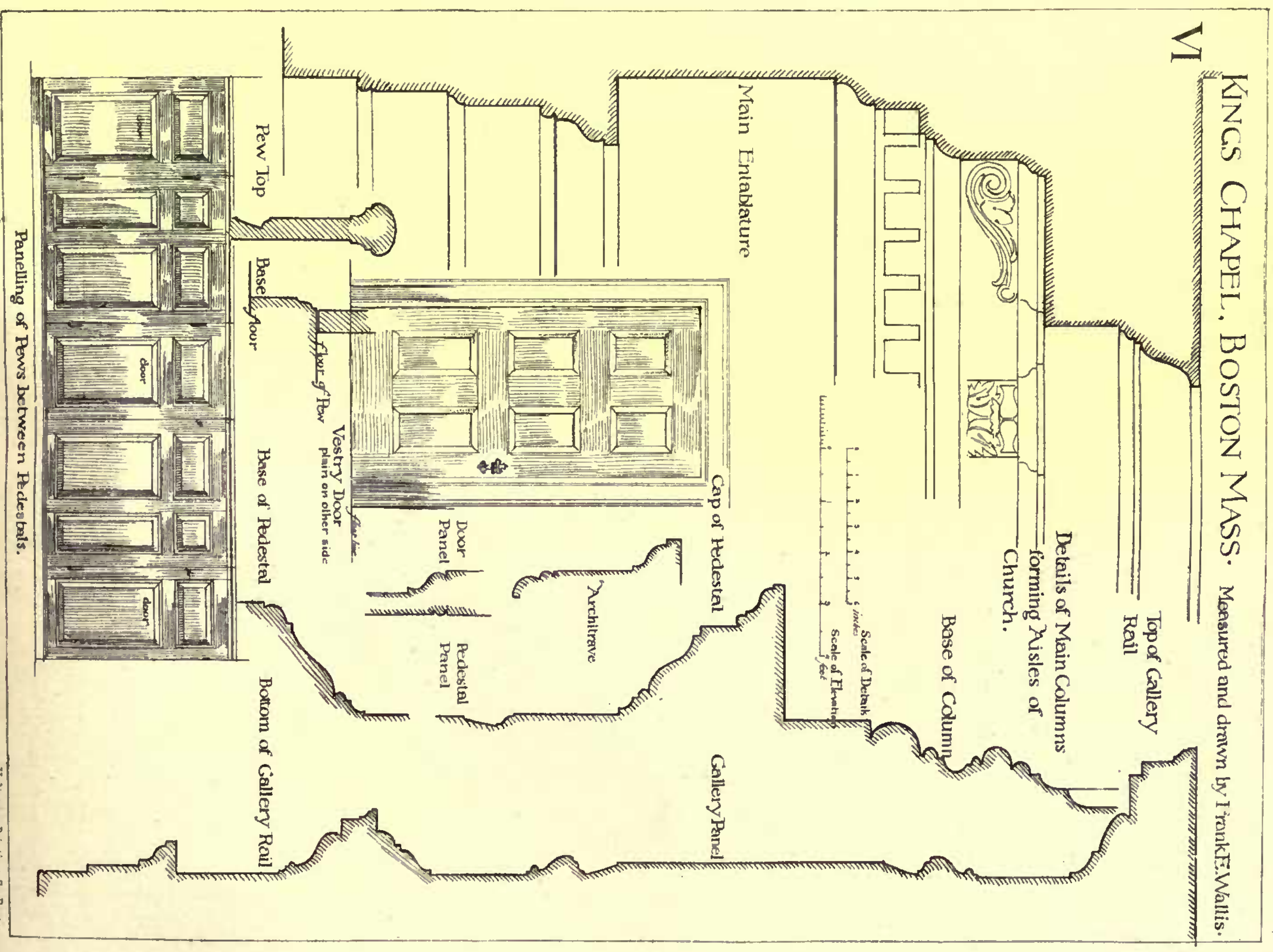


CABIN WITH LARGE HALL, BILLIARD AND SMOKING ROOMS AND RESIDENCE.

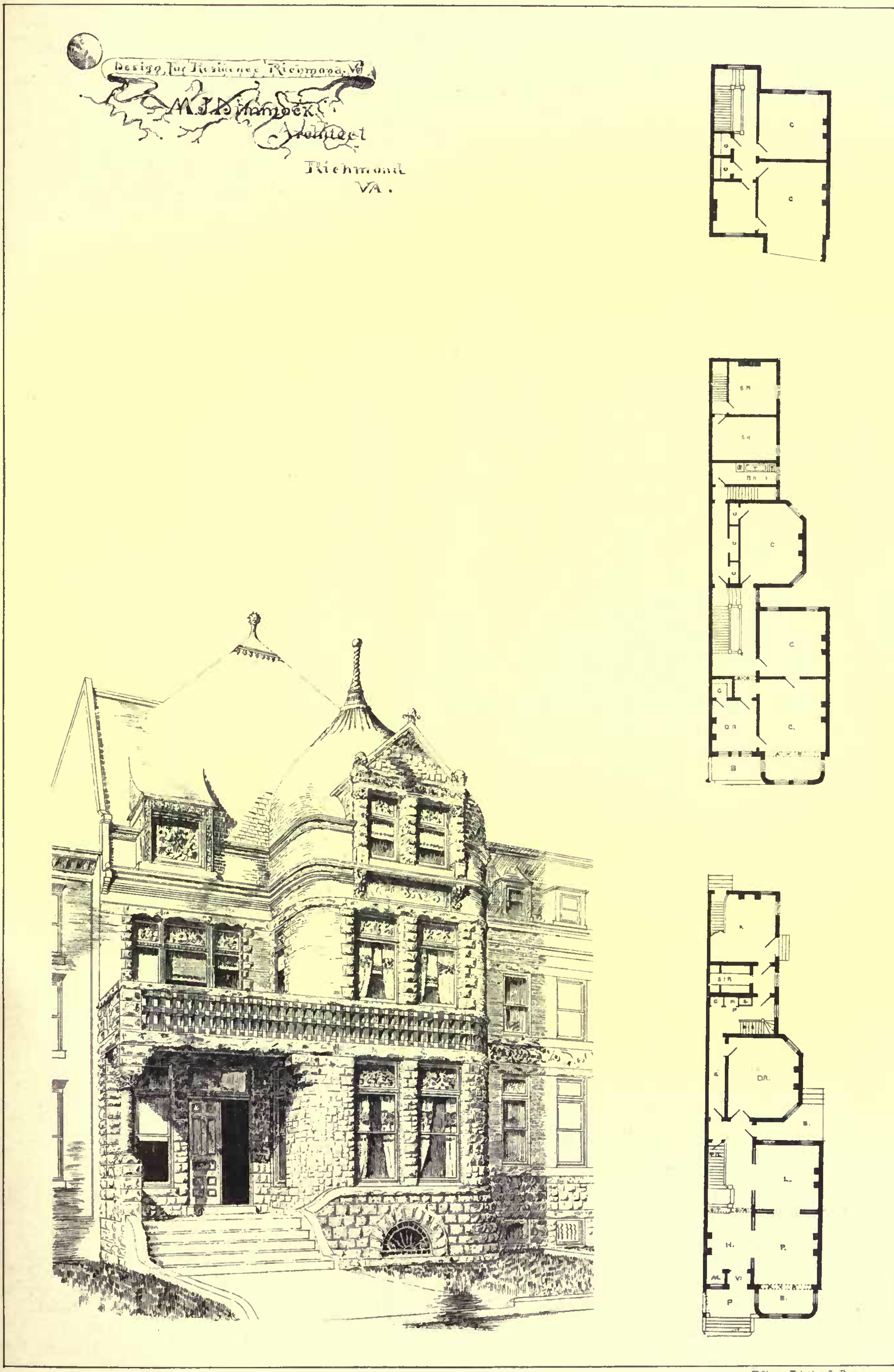
AT FOX HILL · NEAR · PHILADELPHIA, PA.


Sketch · Country · House ·
Charles Edwards, Architect.
Paterson · N.J.
Hall
Sketch · Plan





OLD COLONIAL WORK.



Heliotype Printing Co. Boston.

Return of Checks. — The checks of the unsuccessful bidders will be returned on the award of the contract; that of the successful bidder upon the receipt of the formal contract, properly executed in accordance with these requirements, or upon the satisfactory completion of the work, in case a formal contract shall not have been required, in default of which both check and contract may be forfeited at the discretion of the Secretary of the Treasury.

Members of Firm. — The individual names of a firm submitting a bid must be written out in full in the proposal.

Rights Reserved. — The rights to reject any or all bids, or to waive defects if it be deemed in the interest of the Government to do so, is reserved.

References. — The bids should conform in every respect to these requirements, and will be considered only when received from parties practically engaged in this class of work, who can refer to work of this character satisfactorily performed by them.

Each bidder is requested to examine the site or building so that he may intelligently prepare his bid.

Sub-letting. — The contractor will not be permitted to sub-let any portion of this work without the consent of this office; and whenever such sub-letting is permitted, the party performing the work will be considered the agent of the contractor, and the contractor will be held responsible for any indebtedness incurred by the said agent on account of the work.

The Department reserves the right to retain a sufficient sum, in excess of the ten per cent reserve, to meet any liabilities incurred by the contractor on account of sub-contract, until satisfied that settlement has been made.

Generally. — The contractor must provide all suitable scaffolding, tools, implements and machinery necessary for the proper execution of the work, and employ a sufficient number of workmen to insure the completion of the entire work herein specified, in a proper manner and within the time-limit stated in his bid.

Should any materials of inferior quality be found on the premises, or any incompetent workmen be employed, the contractor, upon receiving orders from the superintendent, the Supervising Architect, or his agent, shall remove such defective material, or discharge such incompetent workmen.

The plans and specifications are intended and accepted as correlative. Any work shown or noted on the plans, but not mentioned herein (or *vice versa*), shall be executed and supplied by the contractor the same as though specially mentioned by both the plans and specification. The plans and specification are intended to include the full and satisfactory completion by the contractor of the work therein provided for, notwithstanding any errors or omissions in one or the other.

The contractor shall not execute any work not originally included in the contract without a written order from the supervising architect, nor without a written agreement as to the kind and quality of the work, and the charges to be allowed therefor.

The general dimensions are shown and figured on the several plans and detailed drawings; the figured dimensions invariably to have the preference over scale dimensions.

As slight variations may have occurred in the construction of the building, the contractor must make his measurements from the actual work, and will be held responsible for the proper fitting, etc., of his work.

Endorsement. — Proposals must be enclosed in sealed envelopes, endorsed: "Proposals for [here is inserted the kind of work and for what building], and addressed to the Supervising Architect.

Damage. — The contractor will be held responsible for and be required to make good at his own expense any and all damage to completed or other work, and must clean up and remove all rubbish which may be made or caused by his workmen.

Quality of Work. — The entire work to be of the best character, executed by skilled workmen and completed to the entire satisfaction of the superintendent and Supervising Architect.

Decisions Final. — The decisions of the Supervising Architect upon plans, specification, sizes, material, or workmanship to be final and binding.

Alterations. — The Supervising Architect reserves the right to make any alterations in or additions to the work to be executed, that may be decided advisable, without in any manner whatever affecting the validity of the contract; the value of such changes to be deducted from or added to the original amount to be paid under this contract at market rates. The contractor, however, will not be allowed any additional compensation for labor or material in the execution of his contract, unless he shall have received written authority from this office and the price shall have been agreed upon, before the execution of the work.

Communications. — All communications from the contractor in regard to the work must be forwarded to the department through the office of the Superintendent of Construction.

JAMES E. BLACKWELL.

[To be continued.]

SAFE BUILDING.—XIII.[1]

CELLAR AND RETAINING WALLS.

ANALYTICAL SOLUTION.

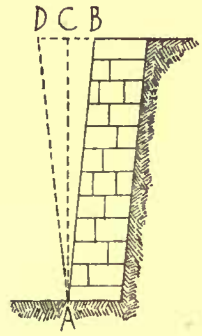


Fig. 49.

THE architect is sometimes called upon to build retaining-walls in connection with terraces, ornamental bridges, city reservoirs, or similar problems. Then, too, all cellar walls, where not adjoining other buildings, become retaining walls; hence the necessity to know how to ascertain their strength. Some writers distinguish between "face-walls" and "retaining-walls"; a face-wall being built in front of and against ground which has not been disturbed and is not likely to slide; a retaining-wall being a wall that has a filled-in backing. On this theory a face-wall would have a purely ornamental duty, and would receive no thrust, care being taken during excavation and building-operations not to allow damp or frost to get into the ground so as to prevent its rotting or losing its natural tenacity, and to drain off all surface or underground water. It seems to the writer, however, that the only walls that can *safely* be considered as "face-walls" are those built against rock, and that all walls built against other banks should be calculated as retaining-walls.

Most Economical Section. The cross-section of retaining-walls vary, according to circumstances, but the outside surface of wall is generally built with a "batter" (slope) *towards* the earth. The most economical wall is one where both the outside and back surfaces batter *towards* the earth. As one or both surfaces become nearly vertical the wall requires more material to do the same work, and the most extravagant design of all is where the back face batters away from the earth; of course, the outside exposed surface of wall must either batter towards the earth (A B in Figure 49) or be vertical, (A C); it cannot batter away from the ground, otherwise the wall would overhang (as shown at A D). Where the courses of masonry are built at right angles to the outside surface the wall will be stronger than where they are all horizontal.

Thus, for the same amount of material in a wall, and same height, Figure 50 will do the most work, or be the strongest retaining-wall, Figure 51 the next strongest, Figure 52 the next, Figure 53 next,

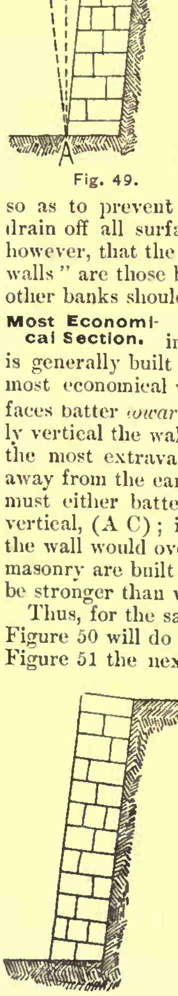


Fig. 50.

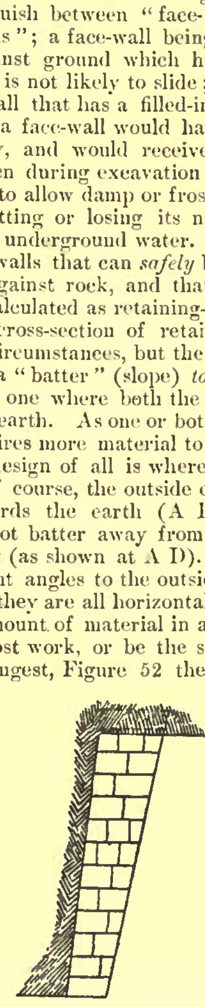


Fig. 51.

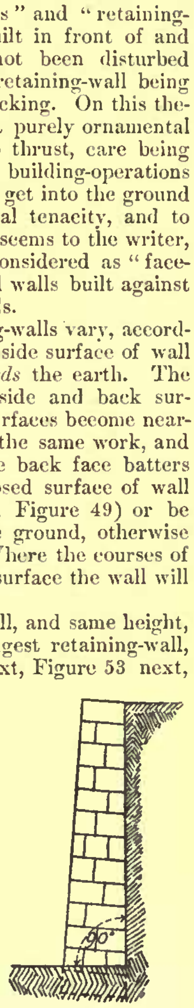


Fig. 52.

Figure 54 next, and Figure 55 the weakest. In Figure 50 and Figure 52 the joints are at right angles to the outside surface; in the

[1] Continued from page 70, number 580.

GLOSSARY OF SYMBOLS. — The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.: —

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
= *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_1 = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
𝔡 = *diameter*, in inches.
𝔯 = *radius*, in inches.
π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{I}, a_{II}, a_{III}, etc., or b, b_{I}, b_{II}, b_{III}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance: —

m = moment or bending moment at *centre*.
m_A = " " " *point A.*
m_B = " " " *point B.*
m_X = " " " *point X.*
s = strain at *centre*.
s_B = " *point B.*
s_X = " *point X.*
v = stress at *centre*.
v_D = " *point D.*
v_X = " *point X.*
w = load at *centre*.
w_A = " *point A.*

other figures they are all horizontal. For reservoirs, however, the shapes of Figures 54 or 55 are often employed.

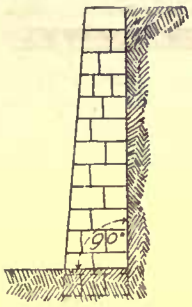
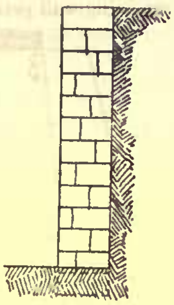
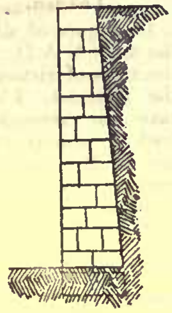


Fig. 53.


Fig. 54.


Fig. 55.

To calculate the resistance of a retaining-wall proceed as follows:

Height of Line of Pressure. The central line or axis of the pressure O P or p of backing will be at one-third of the height of back surface, measured from the ground line[1], that is at O in Figure 56, where A O $= \frac{1}{3}$. A B.

The direction of the pressure-line (except for reservoirs) is usually assumed to form an angle of 57° with the back surface of wall, or

∠ P O B = 57°.

For water it is assumed normal, that is, at right angles to the back surface of wall.

If it is desired, however, to be very exact, erect O E perpendicular to back surface, and make angle E O P, or (∠ x) = the angle of friction of the filling-in or backing. This angle can be found from Table X.

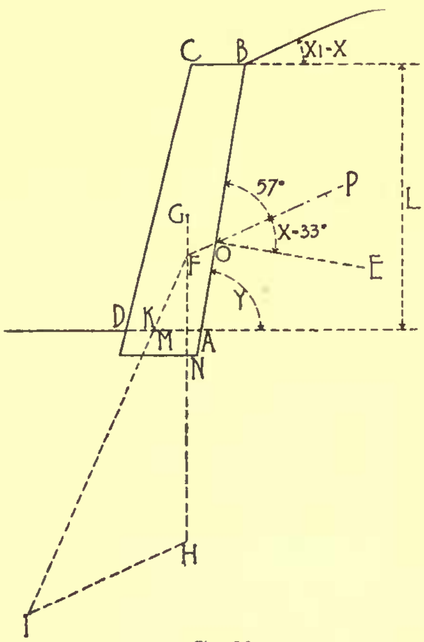


Fig. 56.

TABLE X.[2]

Material.	Weight per cubic foot. w.	Angle of friction. x.
Average (except water)	120	33°
Very compact earth	115	55°
Dry clay	100	45°
Sharp pebbles	110	45°
Dry loam	100	40°
Sharp broken stones	100	38°
Dry rammed earth	110	37°
Dry sand	112	32°
Dry gravel	110	32°
Wet rammed earth	125	27°
Wet sand	125	24°
Wet gravel	125	24°
Round pebbles	110	23°
Wet loam	130	17°
Wet clay	125	17°
Salt water	64	0°
Rain water	62½	0°

Amount of pressure — General case. The amount (p) of the pressure P O is found from the following formulæ:

If the backing is filled in higher that the wall,[3]

Backing higher than Wall.

$$p = \frac{w.L^2}{2} \cdot \frac{\sin^2.\ (y-x)}{\sin^2.\ y.\ \sin.\ (y+x)} \qquad (47)$$

If the backing is filled in only to the top level of wall,

Backing level with Wall.

$$p = \frac{w.L^2}{2} \cdot \frac{\sin.\ x}{\sin\ (y+2\,x)} \cdot \left(\sqrt{\cot.\ x - \cot\ (y+2x)} - \sqrt{\cot.\ y - \cot\ (y+2x)}\right) \qquad (48)$$

Where p = the total amount of pressure, in pounds, per each running foot in length of wall.

Where w = the weight, in pounds, per cubic foot of backing.

Where L = the height of retaining wall above ground, in feet. See foot note to Figure 56.

[1] Where the earth in front of the outside surface of wall C D is not packed very solidly below the grade line and against the wall, the total height of wall N B (including part underground) should be taken, in place of A B (the height above grade line).

[2] Above table of friction angles is taken from Klasen's "*Hochbau und Brückenbau — Constructionen.*" As a rule it will do to assume the angle of friction at 33° and the weight of backing at 120 lbs. per cubic foot, except in the case of water.

[3] The top slope of backing in this case should never form an angle with the horizon, greater than the friction angle.

Where y = the angle formed by the back surface of wall with the horizon.

Where x = the angle of friction of the backing as per Table X.

Even those who do not understand trigonometry can use the above formulæ.

It will simply be necessary to add or subtract, etc., the numbers of degrees of the angles y and x, and then find from any table of *natural* sines, cosines, etc., the corresponding value for the amount of the new angle. The value, so found, can then be squared, multiplied, square root extracted, etc., same as any other arithmetical problem. Should the number of degrees of the new angle be more than 90°, subtract 90° from the angle and use the positive cosine of the *difference* in place of the sine of whole, or the tangent of the *difference* in place of the co-tangent of the whole; in the latter case the value of the tangent will be a negative one, and should have the negative sign prefixed.

Thus, if $x = 33°$ and $y = 50°$, formula (47) would become:

$$p = \frac{w.\ L^2}{2} \cdot \frac{\sin.^2\ (17)°}{\sin.^2\ 50.°\ \sin.\ 88°}$$

The values of which, found in a table of natural sines, etc., is:

$$p = \frac{w.\ L^2}{2} \cdot \frac{0{,}2924^2}{0{,}766^2.\ 0{,}9994}$$

$$= \frac{w.\ L^2}{2} \cdot 0{,}1458 \quad = 0{,}729.\ w.L^2$$

Similarly, in formula (48), we should have for the quantity:

$$\sqrt{\cot.\ x - \cot.\ (y+2x)} = \sqrt{\cot.\ 33° - \cot.\ 116°}$$
$$= \sqrt{\cot.\ 33° - [-\mathrm{tg}.\ (116° - 90°)]}$$
$$= \sqrt{\cot.\ 33° + \mathrm{tg}.\ 26°}$$
$$= \sqrt{1{,}5399 + 0{,}4877}$$
$$= \sqrt{2{,}0276} \quad = 1{,}424$$

Average Case. As already mentioned, however, the angle of friction — (except for water when it is = 0°, that is, normal to the back surface of wall) — is usually assumed at 33°; this would reduce above formulæ to a very much more convenient form, viz.:

For the average angle of friction (33°)

If the backing is higher than the wall:

Backing higher than Wall.

$$p = \frac{w.\ L^2}{2} \cdot \frac{(10 - n.\ 0{,}55)^2.\ \sqrt{144 + n^2}}{(10 + n.\ 0{,}55).\ \ 144} \qquad (49)$$

Or, if the backing is level with top of wall:

Backing level with Wall.

$$p = \frac{w.\ L^2}{2} \cdot \frac{\sqrt{144 + n^2}}{9 + n.1{,}7} \cdot \left(\sqrt{1{,}54 - \frac{n.\ 0{,}4 - 11}{5 + n.\ 0{,}9}} - \sqrt{\frac{n}{12} - \frac{n.\ 0{,}4 - 11}{5 + n.\ 0{,}9}}\right)^2 \qquad (50)$$

Where p, w and L same as for formulæ (47) and (48).

Where n = amount of slope or batter in inches (per foot height of wall) of rear surface of wall.

Thus, if the rear surface sloped *towards* the backing three inches (for each foot in height) we should have a positive quantity, or

$n = +3$.

If the rear surface sloped *away* from the backing three inches (per foot of height), n would become negative, or

$n = -3$.

When the rear surface of wall is vertical, there would be no slope, and we would have

Cellar Walls. $n = 0$.

The latter is the case generally for all cellar walls, which would still further simplify the formula, or, for *cellar walls* where weight of soil or backing varies materially from 120 pounds per cubic foot.

Cellar Walls — general case. $p = w.\ L^2.\ 0{,}138.$ (51)

For *cellar walls*, where the weight of soil or backing can be safely assumed to weigh 120 pounds per cubic foot

Cellar Walls — usual Case. $p = 16\frac{2}{3}.\ L^2.$ (52)

Where p = the total amount of pressure, in pounds, per each running foot in length of wall.

Where w = the weight, in pounds, per cubic foot of backing.

Where L = the height, in feet, of ground line above cellar bottom.

For different slopes of the back surface of retaining walls (assuming friction angle at 33°) we should have the following table; + denoting slope *towards* backing, – denoting slope *away* from backing.

TABLE XI.

Slope of back surface of wall in inches per foot of height.	Value of p for backings of different weights per cubic foot.	Value of p for the average backing, assumed to weigh 120 lbs. per cubic foot.
+4″	$p = 0{,}072.\ w.\ L^2$	$p = 8\frac{2}{3}.\ L^2$
+3″	$p = 0{,}088.\ w.\ L^2$	$p = 11\ .\ L^2$
+2″	$p = 0{,}098.\ w.\ L^2$	$p = 12\ .\ L^2$
+1″	$p = 0{,}112.\ w.\ L^2$	$p = 13\frac{1}{2}.\ L^2$
0″	$p = 0{,}138.\ w.\ L^2$	$p = 16\frac{2}{3}.\ L^2$
−1″	$p = 0{,}157.\ w.\ L^2$	$p = 19\ .\ L^2$
−2″	$p = 0{,}185.\ w.\ L^2$	$p = 22\frac{1}{4}.\ L^2$
−3″	$p = 0{,}205.\ w.\ L^2$	$p = 24\frac{2}{3}.\ L^2$
−4″	$p = 0{,}258.\ w.\ L^2$	$p = 31\ .\ L^2$

Now having found the amount of pressure p from the most convenient formula, or from Table XI, and referring back to Figure 56, proceed as follows:

To find Curve of Pressure. Find the centre of gravity G of the mass A B C D,[1] from G draw the vertical axis G H, continue P O till it intersects G H at F. Make F H equal to the weight in pounds of the mass A B C D, (one foot thick), at any convenient scale, and at same scale make H I $= p$ and parallel to P O, then draw I F and it is the resultant of the pressure of the earth, and the resistance of the retaining wall. Its point of intersection K with the base D A is a point of the curve of pressure.

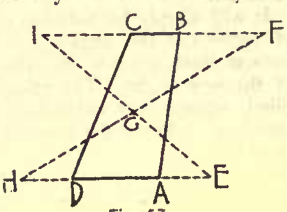


Fig. 57.

Amount of Stress at Joint. To find the exact amount of pressure on the joint D A use formula (44) for the edge of joint nearest to the point K or edge D, and formula (45) for the edge of joint farthest from the point K, or edge A.

Formula (44) was

$$v = \frac{p}{a} + 6. \frac{x.p}{a.d}$$

If M be the centre of D A, that is D M $=$ M A $= \frac{1}{2}$. D A, and remembering that the piece of wall we are calculating, is only one running foot (or one foot think), we should have

For $x =$ K M; expressed in inches.

For $a =$ A D. 12; (A D expressed in inches).

For $d =$ A D; in inches, and

For $p =$ F I, in lbs., measured at same scale as F H and H I; or, the stress at D, (the nearer edge of joint) would be v, in pounds, per square inch,

$$v = \frac{\text{F I}}{\text{A D. 12}} + 6. \frac{\text{KM.FI}}{\text{12. AD}^2}$$

Remembering to measure all parts in inches *except* F I, which must be measured at same scale as was used to lay out F H and H I. Similarly we should obtain the stress at A in pounds per square inch.

$$v = \frac{\text{F I}}{\text{AD. 12}} - 6. \frac{\text{KM.FI}}{\text{12.AD}^2}$$

v should not exceed the safe crushing strength of the material if positive; or if v is negative, the safe tensile strength of the mortar. If we find the wall too weak, we must enlarge A D, or if too strong, we can diminish it; in either case, finding the new centre of gravity G of the new mass A B C D and repeating the operation from that point; the pressure of course remaining the same so long as the slope of back surface remains unaltered. If the wall is a very high one, it should be divided into several sections in height, and each section examined separately, the base of each section being treated the same as if it were the joint at the ground line, and the *whole* mass of wall *in* the section and *above* the section being taken in each time.

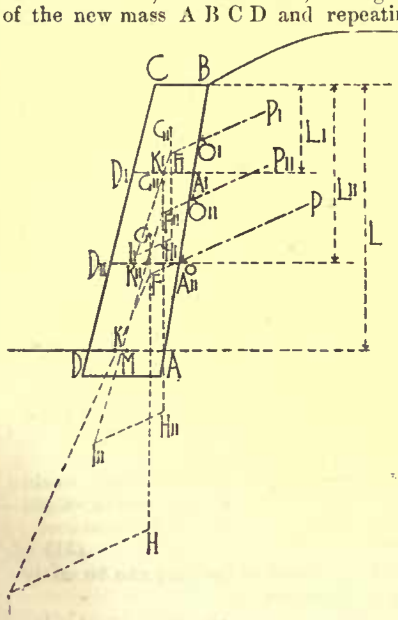


Fig. 58

Thus in Figure 58, when examining the part A_1 B C D_1 we should find O_1 P_1 for the part only, using L_1 as its height, the point O_1 being at one third the height of A_1 B or A_1 $O_1 = \frac{1}{3}$. A_1 B; G_1 would be the centre of gravity of A_1 B C D_1, while F_1 H_1 would be equal to the weight of its mass, one foot thick; this gives one point of the curve of pressure at K_1, with the amount of pressure $= F_1$ I_1, so that we can examine the pressures on the fibres at D_1 and A_1. Similarly when comparing the section A_{11} B C D_{11} we have the height L_{11}, and so find the amount of pressure O_{11} P_{11}, applied at O_{11}, where A_{11} $O_{11} = \frac{1}{3}$ A_{11} B; G_{11} is centre of gravity of A_{11} B C D_{11} while F_{11} H_{11} is equal to the weight of A_{11} B C D_{11}, one foot thick, and F_{11} I_{11} gives us the amount of pressure on the joint, and another point K_{11} of curve of pressure, so that we can examine the stress on the fibres at D_{11} and A_{11}. For the whole mass A B C D we, of course, proceed as before.

Reservoir Walls. For reservoirs the line of pressure O P is always at right angles to the back surface of the wall, so that we can simplify formula (50) and use for rain water:

$$p = 31\tfrac{1}{4}.\ \text{L}^2 \qquad (53)$$

For salt water:

$$p = 32.\ \text{L}^2 \qquad (54)$$

Where $p =$ the amount of pressure, in pounds, on one running foot in length of wall, and at one-third the height of water, measured from the bottom, and p taken normal to back surface of wall,

Where L $=$ the depth of water in feet.

If Backing is Loaded. Where there is a superimposed weight on the backing of a retaining-wall proceed as follows:

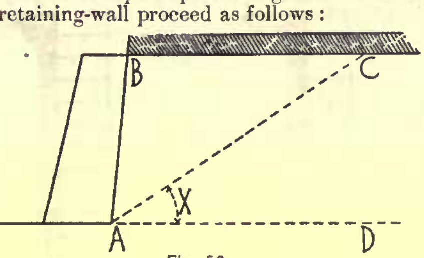


Fig. 59.

In Figure 59 draw the angle C A D $= x$. the angle of friction of the material. Then take the amount of load, in pounds, coming on B C and one running foot of it in thickness (at right angles to B C), divide this by the area, in feet, of the triangle A B C and add the quotient to w, the weight of the backing per cubic foot, then proceed as before, inserting the sum w_1 in place of w in formulæ (47) to (51) and in Table XI, when calculating p; or $w_1 = w + \frac{2.z}{\text{B.L}}$ (55)

Where $w_1 =$ the amount, in pounds, to be used in all the formulæ (47) to (51) and in Table XI, in place of w.

Where $w =$ weight of soil or backing, in pounds, per cubic foot.

Where $z =$ the superimposed load on backing, in pounds, per running foot in length of wall.

Where B $=$ length, in feet, of B C, as found in Figure 59.

Where L $=$ the height of wall, in feet.

Where there is a superimposed load on the backing, the central line of pressure p should be assumed as striking the back surface of wall higher than one-third its length, the point selected, being at a height X from base; where X is found as per formula (56)

$$\text{X} = \frac{\text{L}.\ (w_1 - \frac{2}{3}\,w)}{2w_1 - w} \qquad (56)$$

Where X $=$ the height, in feet, from base, at which pressure is applied, when there is a superimposed load on the backing.

Where L $=$ the height, in feet, of wall.

Where $w =$ the weight, in pounds, per cubic foot of backing.

Where $w_1 =$ is found from formula (55)

When calculating the pressure against cellar walls, only the actual weight of the material of walls, floors and roof should be assumed as coming on the wall, and no addition should be made for wind or load on floors, as these cannot always be relied on to be on hand. The additional compression due to them should, however, be added afterwards.[2]

LOUIS DECOPPET BERG.

[To be continued.]

THE USE OF MORTAR DURING FROST.

SOME time ago the police authorities of Berlin issued an order forbidding the construction of brickwork, should the temperature fall to or below 2° R. (26° Fahr.). This order being based on the supposition that mortar freezes at that temperature, and does not set, Herr Krause, architect, of Stropp, sent a communicatiou to the *Baugewerke-Zeitung*, in which he publishes his experiences, which by no means seem to bear out the necessity for issuing the order. We give a *résumé* of Herr Krause's remarks, as well as of the opinions of some other German architects upon the matter. Herr Krause states that in the winter of 1856 he was compelled to erect a small building during a very heavy sharp frost, the temperature being down to from 4° to 8° R. (23° to 14° Fahr.). As bricks and sand were frozen, his workmen had great trouble in properly setting the bricks, the mortar freezing under their hands. It would have been too expensive to warm all the materials previously. He, therefore, had the lime slaked in small quantities, mixed the mortar hot, and had the brickwork liberally pointed. He fully expected to find the mortar perished in the spring; but he was greatly mistaken, for the work was as firm as if it had stood for several years. In 1880 he had to take the same building down, when the mortar was found so firm that the bricks broke and could be cleaned only with difficulty. Herr Krause subsequently had other pointing done at several degrees of frost, and always found that, if lime mortar had been subjected to frost for about ten days, it had set as firmly as mortar made in the summer in as many months. The architect in question says that, if it freezes, and the frost continues for some time, it is much firmer than when applied in the height of the summer. It is different when a sudden thaw sets in after a sharp frost.

Herr Krause had executed, during an alteration, a wall ten metres high and three metres wide, with three windows placed over each other, and joined to an old brick wall, when suddenly a thaw set in. The wall settled about six centimetres, and bulged out, so that he had great trouble in preventing it from collapsing. A sudden frost, however, made it firm again. After twenty years the wall is as good as ever, and there are no cracks. In that case, however, he had omitted to use unslaked lime, employing only hot water. The bricks had been stored in a heated room. Herr Krause has come to the conclusion that continued frost had the contrary effect upon mortar to what is generally supposed.

Herr A. Klemm, architect, of Stuttgart, expresses the same opinion

[1] To find the centre of gravity of a trapezoid A B C D, Fig. 57, prolong C B until B F = C I = D A and prolong D A until A E = D H = C B, draw E I and H F and their point of intersection G is the centre of gravity of the whole.

[2] Where a wall is not to be kept braced until the superimposed wall, etc., is on it, these should of course be entirely omitted from the calculation, and the wall must be made heavy enough to stand alone.

in a communication which he sends to the *Deutsche Bauzeitung*, in which he says that in the winter of 1848–49 the works required for altering and fitting up the Prussian House of Deputies had to be carried out during a most severe frost. Notwithstanding this fact, the brickwork, executed with freshly-slaked hydraulic lime, was found to be so firm in 1867, when alterations had to be made, that in some portions wedges had to be used in breaking it up. Herr Klemm adds that in his country (Würtemberg) it is the general opinion that frost not only does not injure the brickwork, nor the plastering, but it improves its quality. The frost, however, should continue for some time. Herr Klemm expresses surprise that doubts could be entertained on the subject. A Berlin firm of builders, Herren Ende & Böckmann, writing on the same subject to the *Deutsche Bauzeitung*, state that, in the autumn of 1864, they had orders to erect a warehouse, near Unter den Linden, during the winter. They were at first indisposed to undertake such work in that season; but circumstances demanded speed, and building-operations were continued during the frost. They fully expected to find the brickwork faulty in places when the spring came, and had made up their minds that they would have to replace some of it. They were agreeably surprised to find the brickwork perfectly sound; in fact, it seemed to have set exceptionally well. Since that time the above Berlin firm of builders have not hesitated to continue bricklayers' work as long as they could; that is to say, as long as the water did not freeze on the bricks or the mortar in the pans. It should be added that the lime mortar used at Berlin is said to be of exceptionally good quality. — *The Builder.*

COMMUNICATIONS

"SAFE BUILDING."—CORRECTIONS.

CHICAGO, February 8, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,— In carefully studying "Safe Building"—at top of page 68, February 5, 1887, I find Mr. Berg has made a slight mistake by introducing the decimal point, hence marring the perfection of his able paper. The load on the 12-inch pier being 25,000 pounds distributed over an area of 144 square inches, the pressure per square inch under pier would be $\frac{25000}{144} = 174$ pounds, instead of 17.4 pounds; and the foundation of pier (instead of gable wall), must be made wider, in order to avoid unequal settlement. As the main wall has a load of 30 pounds per square inch on footings, we have, required width of footing under pier $= \sqrt{\frac{25000}{30}} = 29''$ square; 25,000 pounds is not a safe load for a 12″ pier.

Yours respectfully, F. L. LIVELY.

[THE presence of the decimal point was due, not to Mr. Berg, but to the printer, for whom we have made apologies before. — EDS. AMERICAN ARCHITECT.]

THE WEIGHT OF STORED MERCHANDISE. — FLAT ROOFS.

BOSTON, MASS., February 28, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — In answer to Mr. Kidder's inquiry as to the weight of various materials per square foot of floor, I beg to refer him to the tables which are given on pages 118, 119 and 120 in "*The Fire Protection of Mills*," by C. J. H. Woodbury, published by John Wiley & Sons, 15 Astor Place, New York, from which table I made only a few selections to illustrate the communications which I made to you.

Having begun a letter to you permit me now to recur to another subject, to wit, *the roof question*.

The tendency of the half-educated architect to adopt the style of roof to which I once gave the name of "the crazy roof," with its many peaks, inverted pepper-boxes, valleys and other leaky places, appears to have about exhausted itself, and the best architects are coming back to simple and sensible forms and methods of constructing roofs. In some few cases owners are willing to incur the slight additional expense which is required in order to make the roofs of solid timbers set at considerable distances apart, covered with plank in place of thin boards; and in some recent cases I have even heard of the adoption in dwelling-houses of the old and well-established mill method of laying shingles over mortar on the outside of the plank for purposes of safety from fire and to prevent the passage of heat or cold through the roof.

There remains only one more point to be covered which utterly offends the present æsthetic requirements of architecture, to wit: the substitution of the flat-roof or of the roof with a pitch of half-inch to the foot, constructed like the deck of a ship.

Where utility only is considered, as in the factory, no other roof is now thought of for a moment. It has been fully proved in practice that a roof made of three-inch pine, covered with any of the ordinary compounds or with cotton duck properly prepared and properly laid, suffices to keep out the heat of the summer sun and to retain warmth in winter. It also renders even the one-story factory as well as the upper room of the high factory, the lightest and best ventilated and most suitable room for almost every kind of work.

If due attention to art and to architecture can be reconciled to the conditions of the flat-roof or roof of very slight pitch, the upper story of every house and the upper room of every city building may be made the most desirable in the building.

The question presented to the architect, who must provide for the conditions of such a climate as that of New England, is how to reconcile art, architecture and utility in a building covered by a flat roof. Is this beyond the scope or power of the artist or the architect? EDWARD ATKINSON.

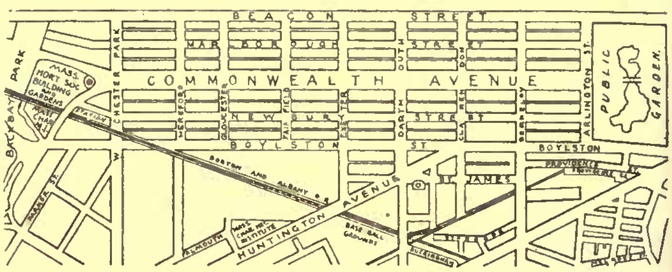
METROPOLITAN IMPROVEMENTS.

BOSTON, February 24.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,— The President of the Horticultural Society says: "There is no piece of ground unoccupied now anywhere in the city, outside of the Public Garden, available for the purposes of the Society." It is not clear what Dr. Walcott means by "the city;" but within Boston's territorial limits there is a rather large acreage still unoccupied, a small portion of which might perhaps wisely be made available for gardens for this Society, such as surely it ought to have for its exhibitions — or if not solely for its own exhibitions, then jointly with another society for general and various exhibitions — like the Horticultural Gardens at South Kensington. Is not this suggestion worth thinking about, and especially if thereby our metropolis could gain largely in beauty and attractiveness?

Is it not evident that the best central line for the future rapid-transit system must be by the Albany Railway to the Providence station, and thence under the Common to Park Street, as the cheapest and most central route by which quick transit between the old city and the new and future West End can be obtained, and the one with which the greatest number of the railways can profitably connect? On this line, at the end of the original lines of Commonwealth Avenue, and between its extension, so-called, the railway and the entrance to the Back Bay "Park," so-called, is an area unoccupied, as yet, except by two houses, the greater part of which land could be used for such gardens with the greatest advantage to the beauty of the city, by preventing the building-up of the oblique line which will so abruptly close the vista of the avenue with the worst possible



effect, there being no apparent *raison d' être* for the bending of the straight lines at this point. The idea of an avenue of such proportions, character and ornamentation being laid out to lead *to nothing but an awkward bend*, must strike every stranger of refinement as a most strange defiance of the laws of taste for the Athens of America to have committed. Nothing less than a structure perfectly palatial in size and ornamentation of façade, or a real cathedral, could look at all well on this portion of the southerly side of the so-called extension of the avenue, or seem to afford a reason for the deflection of the long, straight lines.

We must jump at any possible chance, and leave no stone unturned, to endeavor now — almost hopelessly late though it certainly is — to prevent the building of any more obtrusive houses on this unfortunately designed line, and to remove those that are already built there. I beg, therefore, to ask consideration of the accompanying sketch plan. It provides a new entrance to the "Improvement" grounds, greatly to be desired for direct connection with their easterly side, while the double divergence of the roadway would leave an admirable site for a great monument to the signers of the Declaration of Independence, a Liberty column such as Boston surely ought to have. Would not the Horticultural Society and the Mechanics' Charitable Association unite in leasing and improving the remainder of this area, for exhibition gardens, if gentlemen would unite in securing it for that purpose, the Mechanics' Association purchasing the land on the other side of the railway instead of its present location, and both societies uniting in the erection of a building, the greater portion of which would occupy the ground on the southerly side of the railway, with an annex, connected by a bridge, on the northerly side, the remainder of the ground being devoted to gardens open to visitors to all exhibitions of either society? The site is remarkably well adapted for such purposes, since a railway-station, extending under the bridge of the exhibition-building, could have connection with it by a separate stairway for visitors to or from either side, while objects and material for exhibition could be received at doors in the basement of the building directly from freight cars. Moreover, the intended line of horse-cars over Boylston Street, extended, would pass the entrance of the building on that side.

The time must surely soon come when the Albany Railway can very profitably cease to run its freight trains over this portion of its track, establishing a new freight terminus in the Lowell Street vicinity, to be reached by the Grand Junction tracks, and thus obtaining the facility of running circuit trains between that point and Park Square, and opening the way to a most valuable system of rapid transit; but while no more freight-*trains* should be run over the Back Bay, if these exhibition gardens were established, one or two freight-cars might be attached to late passenger-trains, as occasion might require, to convey exhibition-freight to or from the building.

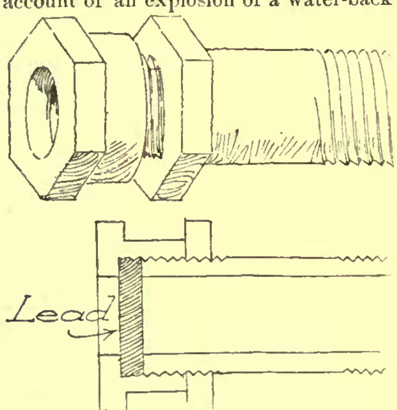
The very convenient situation of the building, and its great extent of southerly exposure, would make it greatly resorted to as a "winter garden" — a great additional attraction to Boston during eight months of the year, while during the other four, evening promenade-concerts in the open gardens, would, no doubt, attract very large audiences. So that, at least eventually, with the future increase of population of this vicinity and the suburbs, these gardens would be very profitable. But if these societies could not at first afford to pay a fair rent for this ground for these gardens, are there not a sufficient number of wealthy and public-spirited gentlemen who would willingly make the investment for low returns for some years, for the sake of saving Commonwealth Avenue from its deformity and gaining so superb a monumental site, and, at the same time, encouraging other railways to connect their tracks with those of the Albany to bring some of their trains to this point, thus paving the way for a better system of rapid transit and long-distance passenger facilities than any other city in America is likely ever to obtain, and thus greatly promoting Boston's advantages and prosperity? Are not these such metropolitan improvements as are due to Boston's reputation for enterprising works of utility and refinement? C.

SAFETY-PLUG FOR WATER-BACKS.

Boston, Mass., February 24, 1887.

To the Editors of the American Architect: —

Dear Sirs, — In your issue of February 12th, your editorial account of an explosion of a water-back in London mentions a valve for preventing explosions, and states, incidentally, that you "can hardly imagine what this valve may be."



An appliance for this purpose is successfully used in Montreal. It consists of a disc of thin sheet-lead, confined by an annular cup against a flanged nipple, which is screwed into the side of the water-back. In the event of the pipes freezing, a fire being started in the range, the steam pressure generated will blow out this lead disc and relieve the apparatus. The pipes being thawed a new disc can be readily inserted. The nipple and cap are made of brass, substantially as shown in sketch annexed, and the device is patented in Canada.

Yours truly, J. M. Betton.

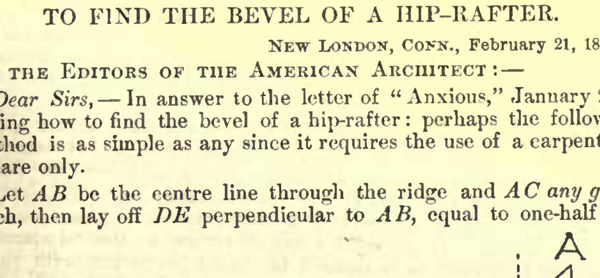
TO FIND THE BEVEL OF A HIP-RAFTER.

New London, Conn., February 21, 1887.

To the Editors of the American Architect: —

Dear Sirs, — In answer to the letter of "Anxious," January 22d, asking how to find the bevel of a hip-rafter: perhaps the following method is as simple as any since it requires the use of a carpenters' square only.

Let AB be the centre line through the ridge and AC *any given* pitch, then lay off DE perpendicular to AB, equal to one-half the thickness of the hip-rafter until the point D falls on the line AC; at the point E draw EF parallel to AC, then the perpendicular distance XY between AC and EF is the bevel required as shown in the section.



Yours very truly, H. G. K.

NOTES AND CLIPPINGS

The Mesquite Tree. — One of the leading timber resources of Texas, the mesquite tree, is described as follows: The bark is regarded as yielding more tannin than the red oak; and the wood of the larger trees, bearing a close resemblance to mahogany in color and general appearance, is largely used in cabinet-making. The bean of the tree is the delight of cattle, and, growing as it does in prolific supply in dry seasons, affords excellent food for all kinds of stock. The tree is first rate as a post timber, and, besides possessing those other qualities, it emits a gum as good, if not superior to the gum arabic, which even now is prepared and used as a mucilage by many of our business men for office purposes. Why may not such benefits be developed and become, at some future day, an article of commerce? Added to all these valuable uses of the mesquite tree, it is in many instances a graceful and ornamental shade tree for the yard. — *Timber Trades Journal.*

Chalets de Necessite, Paris. — The Municipal Council of Paris appears to have solved the difficulty of providing public conveniences for both sexes in a satisfactory manner, and, although what has succeeded in Paris might not be successful in London on account of the differences in the habits of the inhabitants of the two capitals, the requirements of the two peoples are practically the same, and it may serve a useful purpose to put on record the manner in which this public want has been supplied in Paris. The concession to erect what the French call *châlets de nécessité* has been granted to a company for a period of thirty years, the company providing the châlets, and undertaking to keep them in repair, and paying a sum of 800*l* a year to the municipality by way of rent. At the expiration of the concession the whole of the buildings erected by the company are to become the property of the city, the fittings and furniture being taken at a valuation. The company have erected 101 *châlets*, 84 with ten compartments and 17 with four compartments. The cost of the larger of these buildings is about 560*l* each, and of the smaller type about 360*l* each, and the total capital expended is about 53,000*l*, the greater part of which will revert to the municipality at the expiration of the concession. The cost of maintenance of the buildings, irrespective of the fittings, is about 600*l* a year. The amount authorized to be charged for the use of the *châlets* varies from 2½*d* to 1½*d*, but the sums actually charged by the company do not exceed three half-pence, and in some instances are as low as one half-penny. The success of the enterprise appears to be greatly due to the low tariff of charges fixed by the company. Each *châlet* is placed in the charge of a woman, who is required to keep it in order, and is enjoined to use the greatest civility towards the public. The buildings are under the control of a superintendent, assisted by an inspector, and there are three collectors for the receipts, which are checked by a mechanical apparatus placed over the doors of the several compartments. — *The Builder.*

Paris Statues. — This is a question that a large section of the French Press have been lately engaged in trying to give a negative or an affirmative reply to, and not only in respect of Paris, but also of the different provincial towns. Some recently-collected statistics by M. Paul Marmottan, one of the Deputies of Paris, affords conclusive evidence that the capital at all events is not too plentifully supplied with statues, there being but thirty-four in all, including two of Napoleon, two of Voltaire, and one representing the Republic. The list, as given by M. Marmottan, is a very curious one, including, as it does, the statues of Charlemagne upon the open ground opposite Nôtre Dame; of Gutenberg, opposite the National Printing-Office; of Jeanne d'Arc, upon the Place des Pyramides; of Bernard Pallisy, upon the Place St. Germain-des-Prés; of Henry IV, upon the Pont Neuf; of Louis XIII, upon the Place des Voges; of Molière, in the Rue Richelieu; of Pascal, at the foot of the Tour St. Jacques; of Louis XIV, upon the Place des Victoires; of Voltaire, in the Square Monge and on the Quai Malaquais; of the Abbé de l'Epée, near the Deaf and Dumb Institute; of Diderot, upon the Place St. Germain-des-Prés; of Sédaine, in the Square Trudaine; of Malesherbes, at the Palais de Justice; of Haüy, at the Institute of the Blind; of Pinel, at the Saltpêtrière Hospital; of Moncey, at the Place Clichy; of Larrey, at the Val-de-Grâce Hospital; of Ney, upon the Place de l'Observatoire; of Napoleon, upon the summit of the Colonne Vendôme and in the court-yard of the Invalides; of Bichat, at the School of Medicine; of Prince Eugène, in the Gardens of the Invalides; of Béranger, in the Square du Temple; of Lamartine, in the Avenue Victor Hugo; of Berryer, at the Palais de Justice; of Berlioz, in the Square Vintimille; of Alexander Dumas, upon the Place Malesherbes; of Ledru Rollin, upon the Place bearing his name; of Claude Bernard, outside the Collége de France; of Henri Regnault, at the Ecole des Beaux Arts; of Bossuet, Fénelon, Flechier, Massillon, upon the Place St. Sulpice; and of the Republic upon what was formerly called the Place du Château d'Eau, but is now the Place de la République. The history and vicissitudes of all these statues are described in M. Marmottan's book, and the oldest is that of Henry IV, upon the Pont Neuf. It was first erected by his widow, Marie de Medicis, in 1614, and the bronze horse which the king bestrode was originally cast for Ferdinand, Duke of Tuscany, but was given at his death by Cosmo de Medici to his sister. The vessel which was bringing it from Italy to France was wrecked off the coast of Normandy, and the bronze horse remained for a year buried in the sea. After it had been erected upon the Pont Neuf, with Henry IV upon its back, it underwent no further vicissitudes until 1792, when horse and rider were melted down into cannon. A fresh statue was erected upon the model of the original one in 1818, and though the Communists threatened to destroy it in 1871 they did not do so. — *British Architect.*

Another Storage-Battery.— Since the first storage-batteries manufactured by the French electrician Faure arrived in this country on board the *Labrador*, in 1881, there has been a constant effort to introduce the storage-battery as an article of commerce in New York. For some years, in London, this has been done by the companies working under the patents of Faure, Sellon, Volckmar and others, and to-day, in London, many shops and private houses are lighted in this fashion. In New York, each company organized for the manufacture and sale of storage-batteries has become entangled in the meshes of patent litigation, and very few batteries have been manufactured, The latest company organized for the purpose of introducing the storage-battery, as a practical means of lighting buildings, is about three months' old. The new company has built works in Newark, N. J., opened offices in New York, and stands ready to sell plants to people who can be induced to believe in the durability of their apparatus. So far this question has been the stumbling-block of all attempts to bring a practical battery into every-day use. The battery would not last. For a few weeks or months it would answer its purpose fairly well, and then would come to grief. The electricians of the new company believe that their battery will last for a number of years.

The principle of the storage-battery, so far as understood, has been explained over and over again. A plate of lead immersed in acidulated water undergoes certain changes when submitted to the action of a current of electricity. When the current is stopped, it is found that the apparatus will give back a certain amount of the electricity it has received The electricity produces a certain chemical change in the lead; in reverting to its original condition this electricity is again given out. Millions of dollars have been spent in France, Germany and England, to say nothing of the United States, within the last ten years, in devising an apparatus which shall give out a high percentage of the electricity received, and which shall retain its efficiency through years. The advantage of a satisfactory storage-battery is, that while it is necessary to run dynamos at full speed in order to supply even one incandescent light, the electricity for lights fed by a storage-battery can be supplied from a dynamo at any time when waste steam-power is available. Thus, in one country-house, near Philadelphia, which is lighted by fifty sixteen-candle lamps, the battery is charged but once a week. Every Monday a small engine is run in connection with the battery all day, and that is sufficient to store up electricity enough for a week, no particular economy being observed in the use of the light. Wherever waste power exists it is, of course, evident that a durable and efficient storage-battery will be of the utmost value.—*N. Y. Evening Post.*

The Value of London Land. — It has been ascertained, with regard to the Imperial Institute, that the site of about five acres recently secured for the new Admiralty and War Offices is valued at £820,000, or rather over £160,000 per acre; that now vacant in Charles Street, opposite the India Office, is less than an acre, and would cost at least £125,-000; probably another acre might be secured by private contract, so that the value of a limited site in this position would not be less than £250,000. It has been suggested that a single acre not far from Charing Cross might be obtained for £224,000. Two and a half acres on the Thames enbankment have been offered for £400,000, and it is stated that six acres may be procured from Christ's Hospital at £600,000. Another good central position has been suggested consisting of two and a half acres, which has been valued at £668,000. Even if a reduced price were accepted, no site in that direction is to be had for less than a quarter of a million. This explanation is offered for falling back on the site which belongs to the Commissioners of the Exhibition of 1851.—*The Court Journal.*

The Late Sir Joseph Whitworth. — Writing of the late Sir Joseph Whitworth, the *London News* says: Everybody now knows the Whitworth planes, the surfaces which fit so exactly that they slide over one another, as if assisted with some lubricating matter, and on the application of very slight pressure cling together with a tenacity apparently out of all proportion to the pressure of the atmosphere. While engaged in preparing his now celebrated planes he was, of course, laughed at by his fellow-workmen. The man who sat at the next bench was delighted at the joke, although he took, as a good workman always does, considerable interest in a long and, apparently, almost impossible job. Up to that time the most accurate planes had been obtained by first planing and then grinding the surfaces. They were never true. Whitworth's first step was to abandon grinding for scraping. Taking two metal surfaces as true as the planing-tool could make them, he coated one of them thinly with coloring-matter, and rubbed the other over it. Had the two surfaces been true, the coloring-matter should have spread itself uniformly over the upper one. It never did so, but appeared in spots and patches. These marked the eminences which Whitworth removed with a scraping tool till the surfaces gradually became more nearly coincident. But he reflected that the coincidence of two surfaces would not prove them to be planes. If one were concave and the other convex, they might still coincide. This difficulty he got over by taking a third surface and adjusting it to both. By a series of comparisons and adjustments he at last made all three surfaces coincide, and then knew that he had got true planes. When they were done he showed them, one Sunday morning, to his fellow-workman, who was thunderstruck, but rejoiced heartily over the good work done.

The perfect planes made Whitworth's fortune. Bringing them with him from London to Manchester, in 1833, he wrote over his door "Joseph Whitworth, tool-maker, from London." His tool-shop by degrees expanded till it covered ground of the value, estimated in 1887, of £250,000. Throughout his successful career he was possessed with the idea of absolutely perfect accuracy. From his perfect planes he advanced to the wonderful millionth-of-an-inch measuring-machine and the standard screws and gauges which have saved an infinity of labor. When he went into business every manufacturer, or, at least, every county had its own measurement, and it was by his efforts that some approach was at last made toward uniformity. In producing standard measures of length he was at issue with authority and precedent as to the temperature at which the standard was to be of the prescribed length. The accepted temperature is 62° Fahrenheit — too low, as he pointed out, inasmuch as the mere taking of a measuring-bar in the hand must disturb its accuracy. As arms of precision were demanded, Mr. Whitworth turned his attention to the system of polygonal rifling, and suggested the hexagonal plan, which was suggested by the Martini-Henry heptagon. Knowing nothing of firearms when he commenced his experiments, he acquired, with extraordinary rapidity, such knowledge of the theory and practical performance of projectiles that his steel ordnance throwing flat-headed shot is known all over the world, and has been largely supplied to foreign governments. The steel used at his great works at Manchester is made by a process of his own for compressing the fluid metal, and expelling the air, which might otherwise produce huge flaws. Wherever iron in any form is manufactured, the name of Whitworth is held in profound respect

To the greater world perhaps the "Whitworth scholarships" are the medium by which their founder is best known. There are thirty of them, each of the value of £100 per annum, tenable for two or three years, and were instituted for the encouragement of engineering and mechanical science.

TRADE SURVEYS

This week's reports from architects show clearly that the busy season has set in. Investors and projectors have completed their arrangements for the early months of the year, and in the wide scope of their projected operations have shown a confidence that will encourage halting enterprise wherever it exists. The possibility of overdoing is kept constantly in mind. The danger of some sudden spurt in prices will not be lost sight of for months to come. The extraordinary recuperative energies of the country on one hand, and the extraordinary expansion of consumptive requirements on the other, leave projectors, manufacturers, and dealers in a sort of quandary as to how fast or how slow to move, in order to avoid the over-production Scylla and the Charybdis of advancing prices. It is evident that the present rate of expansion of manufacturing capacity cannot be long maintained in iron and steel making. In textile manufacturing, the progress is more regular, and is held in check by foreign competition, and in some lines of goods by home competition. In the hardware industries the increase is legitimate and safe. In machinery we are progressing slowly and without the least possible danger. In agricultural-implement and wood-working machinery interests a steady increase in capacity has been going on. The shop-capacity in all sections is full, and correspondence exhibits a healthy condition for future business. Mining-operations will be conducted on a heavier scale in gold, silver, copper, lead, ore, coal, stone, and slate, and the present well-sold-up condition of the shop and mill capacity supplying such requirements shows it.

This year's railroad-building is over double last year's, and the oversold supply is quintuple last year's sales at this date. Iron and steel imports, actual and contracted for, are fully six times what they were at this date last year. Railroad-earnings are marching steadily ahead per mile, and bank clearings exhibit an increase. Commercial failures reveal a healthy commercial situation. Loans on mortgages are increasing everywhere, but the increase is for legitimate expansion rather than in vain attempts to arrest disaster.

Legislation, both national and State, is exhibiting a vigor and comprehensiveness in dealing with questions of transportation, taxation, and labor, which encourage the hope that there is virtue enough in the people to eradicate indolence. Evil tendencies are developed by the clashings of antagonistic interests. Building-interests proper are taking shape for a year of great and wide-spread activity. Manufacturers are directing their attention in many localities to the necessities of their work-people as to proper housing. Ere long the construction of small houses will become as important a feature of enterprise as the erection of a mill. This field opens opportunities for people and philanthropy. The wage-workers in this and other countries have never exhibited the necessary enterprise to build homes of their own, the daily necessities monopolizing all the earnings throughout the West, as well as in many towns in the Middle and Eastern States. Plans have been completed for the erection of blocks of houses to be rented or sold at the option of the laborers. When profits decline on products, rents on small houses will measurably compensate. The idea has been seized in the South, and factory and mill operatives are to be housed near their work at low cost. These little introductions point to important results. Then again, an influence is at work to crowd out manufacturing in certain lines into smaller towns. Labor agitations, taxation, cost of living overbalance in a great many cities, large and small, the advantages of convenience to the markets and raw material. This movement which labor agitations have precipitated will be carried much farther than the original cause intended. A geographical diversification of certain industries will develop itself to the advantage of employer and employed, and open up one opportunity to reduce the magnitude of the labor problem. Market conditions continue favorable. The strong upward tendency developed during January has been checked. The country has discounted 1887. Prices must, of necessity, be strong and demand steady. Money is abundant, notwithstanding the fruitless efforts at manipulation in the interests of lenders and speculators. English capitalists are encouraged to increase their investments in American railway securities, mines, and manufacturing enterprises. Builders are entering upon season contracts, and a spirit of activity is manifested in all sections. The New England States may not lead in building enterprise, but the investments per head of population will be very little behind even the driving West. Chicago architects and builders, or many of them, have already entered upon important engagements, and leading material-houses are under contract for supplies of all kinds. The Northwest will lead in building of all kinds, from railroad depots and grain-handling facilities down to small houses. In fact, the Mississippi Valley will house and shop itself this year with pioneer-like energy. The centre of industrial activity, like the centre of population, is moving Westward, and the magnet in the Northwest is attracting it in that direction, although the remarkable progress being made in certain sections of the South cannot be lost sight of. The building-interests nearer home, and especially along or near the Atlantic coast, will have an active year, especially in the smaller cities which are able to offer special inducements for new manufacturing enterprise. The anthracite and bituminous coal interests along the coast are promised a general improvement. Miners' wages have been advanced ten cents per ton in bituminous mines, and the anthracite miners are expecting it. This concession affects 20,000 men, and is made to insure uninterrupted production.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, by TICKNOR & COMPANY, Boston, Mass. No. 585.

MARCH 12, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

THE question of the licensing of architects, which has been so much discussed in this country during the winter, seems to have begun after a considerable interval to agitate also our friends across the water. In 1840, a number of French architects applied to the Government for the passage of a law subjecting architects to an examination similar to that which physicians were obliged to undergo, and prohibiting persons who had not passed satisfactorily such an examination from practising the art of construction, at the risk of the public, and of those persons who might have been induced to confide work to their incapable hands. This application, which was opposed by some of the most distinguished architects of the time, was twice rejected by the Government, with the reply, so characteristic of the French, with whom the name of art has something sacred, that an architect, although in one sense a man of science, whose technical attainments could be measured by a given standard, was also an artist, whose imagination should not be hampered by the necessity of conforming his ideas to those of a jury of men who would be likely to see little that was good in anything outside of their own range of sympathies. Persons familiar with the subject could easily see that the greatest and most original of artists, those whose lives have marked chapters in the history of art, would rarely have been able, at the commencement of their career, to obtain the approbation of those brought up in the prevailing school, and eccentric candidates, such as Michael Angelo, Raphael or Rubens among the sculptors and painters, or Labrouste among the architects, or Handel, who shocked the *dilettanti* of his time by his neglect of the rules of harmony, among the musicians, would, if the consent of their professional rivals had been necessary to their admission to practice, have been forced to abandon the career by which they made themselves and their country famous; and as the French are the last people to be willing to deprive themselves of anything either new or beautiful, the whole subject of licensing either architects or any other sort of artists was soon put aside.

FORTY years later, however, it was again taken up, particularly in the professional societies, where, as seems to be the case all over the world except in Germany, which virtually possesses a strict license law, the necessity for doing something to protect architects from the competition of ignorant and dishonest pretenders began to be apparent; and in 1884 the matter was referred for consideration by the Congress of French Architects to certain members, among whom was M. César Daly. This good and wise man prepared a discourse on the subject, which was read at the next Congress, held at Nice in 1885, and portions of which are again quoted in *La Semaine des Constructeurs*. In this discourse M. Daly pointed out that an architect must be considered, as M. Ruprich-Robert cleverly says, to be an artist lined with a scientific man, To make the combination fit for use the lining must be good. and it is quite possible to try and certify its quality, without criticising the color, texture or fashion of the exterior material, and this is what M. Daly thought should be done, testing the science and practical knowledge of the candidate, but avoiding absolutely everything relating to taste or skill in design. The Congress acceded completely to these views, and a resolution was passed, to the effect that the Government should be requested to require from all persons wishing to practice architecture a diploma, relating exclusively to their scientific, technical and administrative attainments, granting, however, a diploma without examination to architects who had been engaged in practice before the passage of the law. So far, as we believe, the Government has not acted upon the petition, and Minnesota or Ohio may yet be the first among civilized communities to try the experiment in this form.

HEAVY snow-storms, although by no means unusual in Boston, seem as yet to have made little impression upon the minds of the builders and engineers of that city, and nearly every severe storm, notwithstanding the rather unpleasant activity which the real-estate owners show in shovelling the snow off the roofs of their buildings onto the sidewalks below, is followed by a collapse of some sort. The last storm, although only about a foot of snow fell, proved too much for the roof of a large rolling-mill in South Boston, which fell, with three or four hundred tons of snow, onto the machinery below, carrying with it the upper portion of the walls. The roof was of a singular pattern, once rather fashionable in Boston, consisting of portions of two parallel cylinders, about five hundred feet long and seventy feet wide. The long valley between such cylindrical surfaces is admirably calculated for catching and retaining snow, and, as was shown by the collapse of a similar roof, which took place a few weeks ago in the same city, the curved upper chord, unless counter-braced with a care rarely found in the design of roofs, is not so well adapted for resisting an unequal loading as one of simpler form; and the effect of the weight of the snow, which was drifted by the wind into the longitudinal valley until it was completely filled, was sufficient to distort the trusses to the breaking point. Fortunately, no one was in the building at the time, but the loss by the destruction of the roof and of the valuable machinery upon which it fell will be heavy.

A VERY kind professional friend of ours, in speaking of the case of disputed charges to which we referred lately, remarks that architects would find it very much to their advantage to keep printed schedules of charges, to be put in the hands of their clients as early as possible, one of the clauses in which should mention that plans and specifications were expected to be paid for, whether carried out or not. This gentleman, who has a schedule including such an expression printed on the last page of his office note-paper, says that he has found it of great use in a case which he was compelled to bring into court, and most architects of experience will add their testimony to similar effect. There are various ways of conveying the information contained in the schedule in such a way that one's clients can be sure of becoming acquainted with the terms offered them, without disturbance to the friendly and confidential relations which architects wish to maintain with those to whom they render service. One of the best forms that we have seen is that adopted by a certain professional firm, in which the schedule of terms, in a condensed form, and in small type, stands at the head of every sheet of office note-paper. It would be hard for any one who had ever received a letter written on such paper to prove, to the satisfaction of a jury, that he had never read the heading, yet the schedule matter, which is printed in brown ink, is so small and so neatly arranged as to form little more than an unobtrusive ornament at the top of the sheet. Several other architects whom we know have their price-list printed on the back of their business cards, one of which they enclose to every new client, and many more, who do not have much occasion for cards, use printed slips of paper in the same way. Any of these devices will answer, and one of them should certainly be adopted by every prudent architect.

IT is pleasant to find one's work praised by others, and American architects will be pleased to read what the *Bautechnische Zeitschrift* of Berlin has to say about their ways of designing country houses, in its issue of January 15. The *Zeitschrift* reproduces an illustration of one of these mansions, from *Carpentry and Building*, and introduces its remarks by saying that the conviction is becoming more and more general abroad that the country houses of America merit, in a high degree, the attentive study of European architects. In design, as it says, without exhibiting any effort after what is known as the higher architecture, they possess an air of independence and comfort, together with an evident adaptation to the varying tastes and requirements of their inhabitants, which excite interest and pleasure, particularly in persons who have become tired of the stately, but often deceitful symmetry of Continental city fronts. Partly, as it thinks, through the evident endeavor to suit the building to the habits of the owner and his family, and partly through the simplicity with which the necessity for economy has taught us to use materials, the American country houses possess a picturesque charm which is wholly their own, and which can be traced neither to the broad, unbroken roofs which economy teaches us to use, nor to the compact but varied plan, or the clever devices for utilizing materials and space, but is a product of all these combined. In regard to practical details of arrangement and construction, the *Zeitschrift* finds as much to praise in the work of American architects as in their composition of lines and surfaces. The planning of the rooms, the ample provision of closets, the successful avoidance of vacant and useless corners, all seem to it to show a care and skill on the part of our architects as remarkable as the thoughtfulness which leads us to provide roof-plans, a thing apparently unknown in Europe, for the guidance of the framers and skylight-makers; and it is still more pleased, if possible, with such matters as the double-hung windows and the sliding-door mechanism, which are so familiar to us that there is something surprising in the idea that any one should find in them anything new or praiseworthy.

THE annual account of theatre fires, for the year 1886, has been published in Germany, and is reproduced in the *Wiener Bauindustrie Zeitung*. In all, only eight theatres were totally destroyed during the year. One of these was in Derby, England, where an explosion of gas behind the scenes set fire to the building, and one actor and two workmen were unable to escape in time to save their lives. The second was at Bochum, in Germany, where a disused theatre was destroyed; and the third at Ravenna, where fire caught in a dwelling-house attached to the theatre known as the Teatro dei Filodramatici, and was communicated to the auditorium so quickly that one woman was suffocated. The fourth was in Madrid, the fifth in Orleansville in Algiers, and White's Theatre in Detroit furnished the sixth, none of these fires causing loss of life. The seventh was in Lemberg, where a fire in the cellar of the theatre was extinguished before it could spread further; and the last was in India, where the theatre of Tinnevelly was destroyed, with a loss of about a hundred lives. As compared with 1885, the year shows no improvement, the number of fires having been the same, and the loss of life not very different; but either of these years was better than 1884, and since 1882, when twenty-five theatres were burned, there has been a very great improvement, due partly, as it would seem, to the stricter rules in regard to construction which are now enforced, and partly to the increased care which public opinion has demanded since the dreadful catastrophes at Brooklyn and Vienna.

IN its capacity as official gazette of the Exhibition of 1889, *Le Génie Civil*, gives many interesting indications of the character of the future exhibits. Among other things, an historical exhibit of methods of artificial lighting is to be prepared, showing the progress of this great modern art from the rush-light and the pine-knot torch to the first-class electric light-house lanterns of the present day. The buildings and grounds of the Exposition itself will furnish a striking example of the present state of the science of illumination at its height. It is decided that the main exhibition building, including the whole of the Champ de Mars, shall be fully lighted every night, leaving the palace of the Trocadero to be illuminated only by lines of exterior gas-jets, as a pretty object to close the perspective view across the river. So far as the buildings themselves are concerned, everything is already being pushed to the utmost. The enormous structures of the Champ de Mars, with their roofs of two hundred and fifty feet span, are to be ready for beginning the setting of the glass roofing on the first day of next July, and in a few days the seed will be sown, in a reserved portion of the Parc aux Princes, which is to furnish turf for the "*pelouses*" of the Champ de Mars and the Trocadéro garden. Hitherto, the grass intended to beautify the grounds about exhibition-buildings has usually been either a scanty vegetation, raised on the spot from seeds sown a few weeks before, or a fictitious turf, produced by Mr. Olmsted's clever device of sowing rye and keeping it closely mown; but the Paris grass of 1889 will be cultivated by itself for two years, until it has formed a close, well-rooted sod, and will then be stripped off and transferred bodily to the place intended to receive it

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SOME singular railway accidents have occurred recently through the effect of wind, the pressure of which does not seem to be taken into account by the designers of cars. Not long ago a passenger-train in Colorado was almost entirely blown off the track — four cars, if we recollect rightly, two of which were of the very heavy Pullman pattern, having been overturned. Fortunately, the accident happened in a place where the cars had not far to fall, and no lives were lost, but the train had just passed over a viaduct across a narrow valley, in the very situation where the strongest gusts might be expected, and where they would have precipitated the train some sixty feet to the rocks at the bottom of the ravine. In Russia, a few days later, a similar accident happened to a freight train, which had just started out of the station. It had proceeded only a few rods, and had not reached its full speed, when a gust overturned several cars in the middle of the train, twisting off the couplings, and throwing them entirely off the track, while the engine and the rear cars remained in place. The overturned cars were empty, and very light, but they presented a small surface to the wind, and it was calculated that a velocity of one hundred and twenty miles an hour would barely have blown them over if they had been uncoupled, and a considerable additional force must have been required to break off the heavy links which connected them to the rest of the train. It is not very difficult either to calculate the resistance which a passenger-car, at least, would present to the overturning effort of wind of the maximum recorded velocity, or to design it in such a way that the resistance would exceed the overturning force, with a considerable factor-of-safety; and railway companies ought to be held strictly responsible for any negligence of their officials or professional advisers in allowing the use of cars with which such occurrences would be possible.

PERHAPS some of our readers do a little decoration as amateurs, or know some professional decorators or ornamental painters who would be glad of the useful hints to be derived from the Japanese drawing-pen, which we find described and figured by M. Guérineau in *La Semaine des Constructeurs*. Every one knows that the Japanese use the brush where we use the pen, and their drawing-pen is really a drawing-brush, so arranged as to give a straight, even line with the smallest possible trouble. For this purpose a half tube of sheet-brass is provided, of the proper diameter for receiving the handle of the brush, which, for this purpose, is made cylindrical, instead of being tapered. To prevent the lower portion of the half tube from being in the way of the brush, a little offset is made in it, and the lowest portion is flattened and cut in a line oblique to the axis of the tube, and the upper end is flattened and cut in the same way, but without an offset. To use the tool in drawing a line a straight-edge is put on the paper, or other surface, and held in place with one hand, while the other draws the half-tube, and the brush in it, along the straight-edge. The handle of the brush is held in the half-tube with the fingers, which slide it upward or downward, so as to make a fine or coarse line, or lift the brush off the paper, at pleasure. Although the apparatus is so simple, it gives a perfection of line, and a rapidity of execution, far superior to any thing which can be obtained by our process of dragging a long striping-brush slowly over a line made with a blackened string; and it would not be difficult to utilize it for drawing circles and spirals, of a kind which the striping-brush cannot pretend to execute. In drawing on paper, the oblique point formed by the handle of the brush-holder is used for making those indented guide-lines which play so large a part in Japanese work.

THE WATER-SUPPLY OF BUILDINGS.[1] — III.

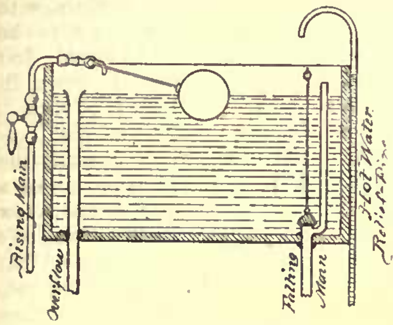


FIGURE 2 represents the usual so-called "Indirect" system of cold water supply-piping. The initial cut gives a detail of the tank. It is generally constructed of strong plank, and preferably lined with fourteen or sixteen ounce tinned copper. The use of lead for lining, though common, is not to be recommended on account of the injurious action produced by many kinds of water on the metal. Iron, properly protected from rust, forms an excellent material for tanks. Either wrought or cast iron may be used in plates, and put together with strong rivets or bolts.

The tank is supplied by the rising main through a strong ball-cock. An overflow-pipe must, of course, be provided wherever ball-cocks are used, since these are always liable to leak as soon as their washers become worn. It is no uncommon practice to trap this overflow-pipe with a deep-seal trap, and then discharge it into the nearest soil or waste pipe. It is difficult to understand how plumbers, who pride themselves so much upon their practical training, can fall into so gross an error as this. The water in the trap is likely to evaporate long before a leakage in the ball-cock occurs, and an open avenue is established to conduct soil-pipe air into the house, and impregnate the water in the tank. The overflow-pipe should discharge into the nearest sink or other plumbing fixture in full view, where a leakage may be discovered as soon as it occurs. To provide a convenient means of removing the sediment which invariably falls to the bottom of the tank to a greater or less extent according to the quality of the water, the overflow-pipe is constructed in the form of a stand-pipe, which when lifted from its seat allows the entire contents of the tank to escape.

The down-pipe or "falling" main is often provided with a valve or stop-cock with an air-tube at the top as shown, in order to

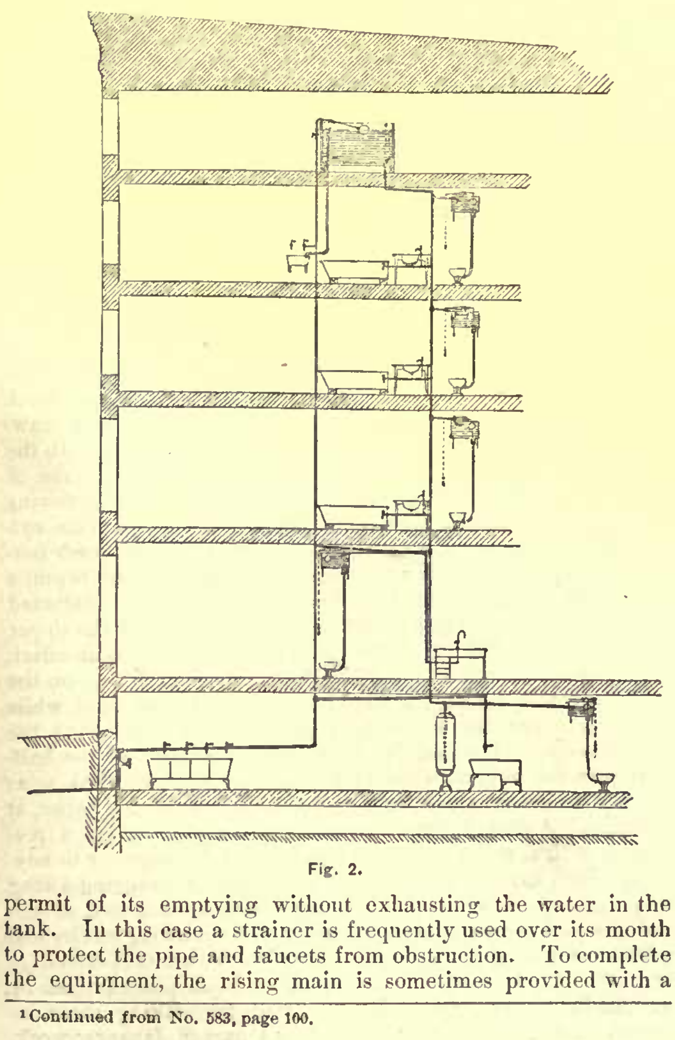


Fig. 2.

permit of its emptying without exhausting the water in the tank. In this case a strainer is frequently used over its mouth to protect the pipe and faucets from obstruction. To complete the equipment, the rising main is sometimes provided with a stop-cock as an extra precaution or convenience when it is desired to cut off the supply at this point, as for instance in repairing the ball-cock.

[1] Continued from No. 583, page 100.

A great deal of this work, however, can be avoided as an unnecessary complication. It would be much better to construct the tank as shown in Figure 3, omitting the stop-cock on the rising main, and the valve, air-pipe and strainer, on the falling main, and simply building a perforated sheet-copper partition across one end of the tank as shown in the drawing. As the water enters the tank from the rising main, it gradually deposits its sediment on the bottom of the tank before it passes the partition. Floating matters are arrested by the upper part of the partition, which thus fulfils the office of the strainer. It has, moreover, the great advantage over the latter of being permanently efficient, since its action cannot be destroyed by clogging. It would not be sufficient to substitute for the partition a simple prolongation of the mouth of the falling main a few inches above the bottom of the tank, because the disturbance of the surrounding water when the falling main was in rapid use, as for water-closet flushing, would stir up the sediment and wash it into the pipe.

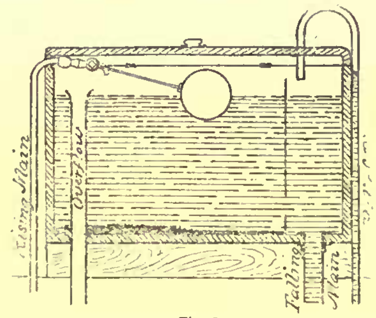


Fig 3.

It is sometimes argued that the valve over the falling main is needed to prevent the waste of the tank-water when it is desired to empty this pipe.

This is, however, a great mistake. It is rarely necessary to empty the falling main, and certainly never more frequently than is desirable for an efficient flushing of the main soil and drain pipes. These should be periodically thoroughly flushed by a sudden discharge through them of the entire contents of the tank, and means should be provided for effecting this discharge in such a manner as to fill the soil and drain pipes as nearly as possible "full-bore." It must be remembered that we are not speaking of a *storage reservoir*, which we shall touch upon hereafter, but of the house-tank constructed to contain only enough water to supply the daily wants of the household. Partly for the purpose of permitting of this thorough periodical flushing, we construct our falling main of pipe of large calibre, not less than two inches in diameter, and see that all the faucets and valves connected with it, as well as the tank overflow-pipe (also made of large calibre, and discharging into a fixture with a large outlet) are opened simultaneously so that the tanks shall be emptied as rapidly as possible into the main waste-pipes.

A stop-cock may be placed in the falling main, just above its connection with the kitchen boiler, so that this may be disconnected in case of needed repairs without interrupting the water-closet supply. The sediment in the bottom of the tank should then be swept into the overflow-pipe and the whole tank thoroughly scoured out. If a cover be provided for the tank as it should be, and as shown in our drawing, and the cleansing be attended to once or twice a year, the water will be clean enough for all domestic purposes, even including cooking and drinking. The water taken direct from the rising main will generally be cooler than that taken from the tank, and for this reason it is well to supply one cold-water faucet on each floor or in each toilet-room from the former, for drinking purposes.

To permit of easy cleansing, the tank should be located in such a place that it will always be convenient of access, and to ensure it against freezing, a warm place should be selected.

The shut-off cock at the tank on the supply-pipe is unnecessary, because we have the ball-cock itself, which can be temporarily closed by propping up the float. The main shut-off, also in the basement, serves the same purpose when the pipes are to be left in disuse for a long time.

Let us now follow the falling main and its branches, as they descend through the house. Figure 2, already referred to, represents the ordinary method of running these pipes. The rising main supplies direct only the cold-water faucets of the kitchen and pantry sinks, the main tank, and perhaps the laundry trays, a faucet in each toilet-room for drinking-water, and such fixtures as are much more conveniently accommodated by it than by the falling main, and as would not be seriously affected by a heavy direct pressure when this occurs, or by

sudden changes in the pressure, or by a temporary suspension of the water-supply altogether. The remaining fixtures, as well as the boiler, are supplied by the falling main. We see here the usual special water-closet cistern for each water-closet used.

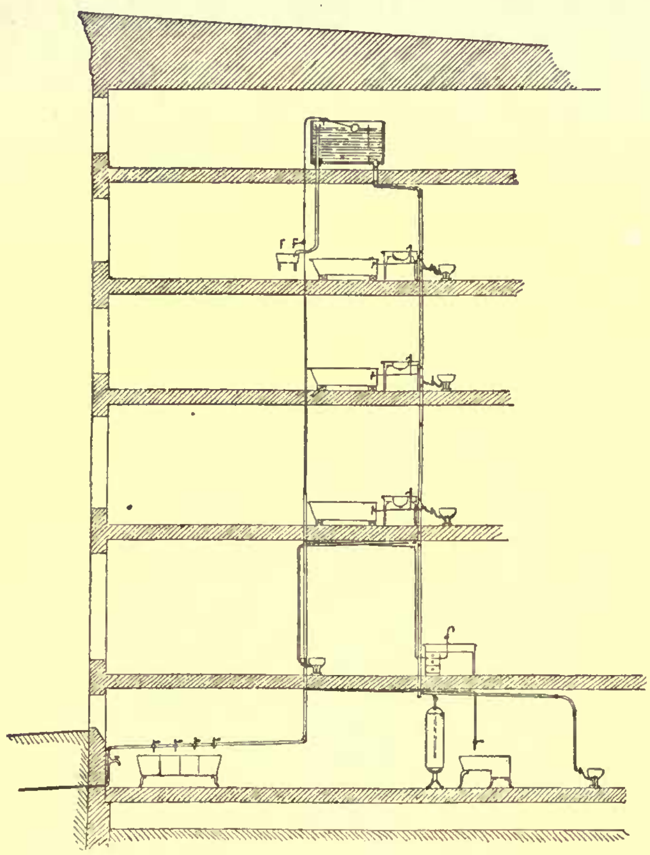


Fig. 4.

Figure 4 shows a simpler and safer method of piping the same fixtures. The falling main is constructed of two-inch wrought-iron gas-pipe, protected by the Bower-Barff rustless process. The plumber can obtain of the manufacturers an assortment of the pipe in standard lengths of an even number of feet, to avoid cutting, say of five and ten feet long, with shorter pieces, two, one, three-fourths, one-half and one-fourth feet long, for making special connections, all threaded, and treated after threading with the rustless coating, together with a regular outfit of elbows, tees, and couplings of the usual and necessary kinds, similarly treated by the manufacturers, and all ready to be put up rapidly, cold, by the plumber, without other tools than ordinary gas-fitters' tongs.

This method of water-closet supply has all the advantages combined of the special cistern supply and of the "direct" supply systems. It has the unvarying pressure of the former and the simplicity of the latter, without the objections of either. The pressure at any one closet is always the same, and the quantity of water delivered at all may be made equal by the use of simple diaphragms at the water-closet couplings. In this way the same size and kind of valve is made to serve at each and every closet in the house. The valves are rendered self-closing by the construction and operation of their levers, so that no more than a certain regulated quantity of water will be used at any flush.

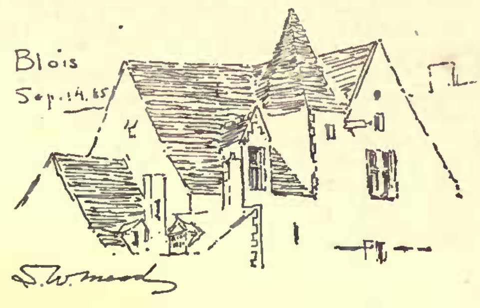
Thus we find that the "tank supply" becomes more economical, as well as better than the "direct supply" system.

J. P. PUTNAM.

[To be continued.]

A CHICAGO BILL FOR CLEANING AND PAINTING A WALL.—The *Springfield Republican* says that "a smart bit of practical politics was the assignment to the book-keeper of 'Mike' McDonald, Chicago's boss gambler, of a contract to clean and paint the stone walls of the court-house at the rate of thirty cents a foot, or some $98,000 for the whole job. The contract was so manipulated as to give five prices for what was only two processes, thus: for 'removing incrustations,' seven cents; for 'restoring the stone to a smooth surface,' 'arresting progress of decay,' 'hardening and preserving the stone,' and 'closing the pores and water-proofing,' five and three-fourth cents each. What was done was to go over the building with fine wire brushes and then apply a white lead paint, adulterated with zinc white, blue clay and powdered limestone."

UTILIZATION OF TOWN SEWAGE BY IRRIGATION.[1]—I.



ALLOW me to thank the Council for having given me this opportunity of stating the case of sewage-irrigation, in accordance with my request. I made that request immediately after I had read Dr. Tidy's paper upon the treatment of sewage. Having read the abstract, I considered it a veiled attack upon the principle of sewage-irrigation, which required a specific reply. When I read the paper upon which the abstract was founded, I could only wonder still more at the reasons for attacking the principle I advocate in the terms which are set forth by Dr. Tidy. My paper is, therefore, an answer to the charges against sewage-irrigation which are contained in that paper and report.

It is not my intention to analyze the figures submitted by Dr. Tidy in his very exhaustive paper. I value it very highly, and if it had not contained the decided onslaught that he makes against irrigation, I should have only had praise and thanks for his work; indeed, I shall quote it in this paper, and use his facts in support of the principle which I advocate. It is of supreme importance to the interests of our nation at this particular juncture. I take Dr. Tidy's own figures in connection with those facts, and the estimated value which he places upon London or town sewage of 1¾*d.* per ton, which is, in the aggregate, a higher value than I have been accustomed to assess it. He says: "I think you may take it that 8*s.* or 9*s.* is more nearly the actual result than any other figure that I [Dr. Tidy] can arrive at." He is of opinion also, most decidedly, that the chief manurial value of sewage is in the urine, which he places at "from 6*s.* 8*d.* to 7*s.* 6*d.* per year for each adult." I am content to take his estimate of the value of both solid and liquids, though in my reckoning I have only take it as equal to the manurial value of one sheep—that has been put at 5*s.* by eminent agriculturists, who drew their inferences from actua practice. I am content to take it as a figure easily reckoned. That sum is capable of being obtained from ordinary town sewage, if scientific supervision is practised upon a sewage-farm; that is, a return of £25,000 a year is capable of realization from the sewage of 100,000 people when properly applied. On this low calculation, at least £5,000,000 a year is lost to the nation by present customs. Let me, however, guard myself at once from misunderstanding. I do not assert that £25,000 a year is the profit which is to be realized, any more than a farmer, when he states that he has obtained ten or twelve bushels of wheat to the acre, means that such a result is all profit. This is the rock upon which sewage chemists and sewage doctors have been wrecked—they have assumed the result to be profit to the operator. It is no such thing. There may be no actual profit to the farmer upon the whole working of the farm, if he has to pay an exorbitant rent for it, and high wages to his servants. But there is another side to the question. If he grows so much produce from the land, the production of the food must be a benefit to the country, though it may not directly profit the individual. If £25,000 worth of produce is raised from a given area, which under other kind of cultivation only raise £5,000, or at most £10,000 of produce, it must be a manifest advantage to the State. That is my point. Let me put the case broadly to start with. An acre of ordinary land, under ordinary cultivation, may show £10 as the result of fair farming. If artificial or other manures have been used upon the land, the cost of such application must be deducted from the total value of produce, as being caused by outside influences. A thousand acres may show at the outside £10,000, as the annual outcome of farming in ordinary and average country places. Nowadays, farmers have to be content with a lower figure than that. I contend that 1,000 acres under proper sewage farming will have no difficulty in showing a return of £25,000, if it be managed upon correct principles as a sewage-farm, and the country is enriched in consequence to that extent, though the municipality utilizing the sewage may not get any actual profit upon the transaction, because other charges swallow up the proceeds.

It was my privilege to take part in a Conference upon the sewage of towns, which was held in Leamington on the 25th and 26th October, in the year 1866, under the presidency of Lord Leigh. At the end of the reading of paper and discussions, lasting two days, a resolution was carried unanimously, to the following effect:

"That this Conference is of opinion that the system of irrigation, when carried out in a scientific manner, removes the difficulty which arises from the present noxious plan of polluting the rivers of England, but that there are circumstances in which other systems may be applicable, and that this Congress considers that no system can be laid down which shall be suited to all towns."

I had the privilege of moving the first half of the resolution, which was accepted by the larger portion of the meeting, but then, as now, there were chemists, patentees, and would-be company formers, who, whilst unable to resist the evidence afforded at that time, in favor of

[1] A paper read before the Society of Arts by Alfred Carpenter, M. D., M. R. C. P., London, and published in the *Journal of the Society of Arts*.

broad irrigation, were not to be turned from their own views, and I accepted the second part as a rider to the first, for the purpose of securing a unanimous adoption by the assembly.

A further experience of twenty years, partly in superintending a large sewage-farm, more lately in watching the work of others, has satisfied me that the experience which had been gained in 1866, has been fully borne out by more recent operations. My paper at that Conference was styled, "The Successes and Failures of the Croydon Local Board." I did not then, as I do not now, fail to recognize the enormous difficulties under which the subject of sewage utilization is placed, because it is so intimately connected with the liberty of the subject, with popular fallacies, and with local self-government. A benevolent despotism, or an autocrat with complete, personal and Imperial power, would have settled this question long ago, to the manifest advantage of this kingdom as a nation, especially to the great advantage of the meat and milk consumer, and to the taxpayers in general, however much it might have apparently added to the indebtedness of the individual locality. It does not follow that a people is made poorer by such an indebtedness. The money paid by France to Germany, after the last Franco-German war, was thought to be a tremendous weight upon the shoulders of the French nation. It is now a source of wealth to the latter people, and assists them to bear the taxation imposed in consequence of it almost with impunity. So also the loans raised in localities like Croydon, which will be paid off in fifty years from its foundation, will then leave a magnificent estate to the ratepayers, which will assist to materially mitigate the incidence of local rating in our particular locality, and the borough, as well as the country, will be correspondingly enriched by the transaction.

I am not going to say a single word against any of the rivals of broad irrigation. I am quite as ready to accept the rider to the Leamington resolution as I was twenty years ago, but I am still more satisfied than I was then that there are few towns in which broad irrigation is not applicable, and that the plan adopted by towns on tidal rivers and seaboards, in turning their sewage into the sea, is unjustifiable, is unpatriotic, is selfish, and contrary to correct principles of political economy. It ought, in consequence, to be strictly prohibited by Parliament as an addition to that Act, which is now beginning to cause to cease the pollution of the rivers by inland towns.

I will now return to Dr. Tidy's paper, and taking his framework as my skeleton, I will deal with the fallacies contained in it in my remarks upon the general subject. He acknowledges that commission after commission has been issued for the purpose of inquiring into the "Sewage of Towns." Select committees have also been held, and in most, if not in all cases, reports were made by men eminent as chemists, as engineers, and as agriculturists, distinctly in favor of irrigation for the purpose of dealing with town sewage, and numerous committees of the Houses of Parliament have reported in its favor.

Dr. Tidy divides his subjects into four heads:

1. The method of applying sewage to land.
2. The soil best suited for irrigation.
3. The crops most suitable for a sewage-farm.
4. The value of the crops so grown.

1. The method of applying sewage to land is, to my mind, of the greatest importance. Dr. Tidy scarcely touches upon this part of his subject, and in avoiding its consideration, leaves his foundation insecure. If sewage arrives stinking, if it comes into the carriers like a mixture of ink or dark coffee, and full of floating particles of confervoid growth, the local authority is in fault. The solids in the sewage are of very little value. Dr. Tidy puts them at about 1*s.* 2*d.* per head per year. That may be their value, perhaps it is rather greater than that sum, if the fæcal evacuations are brought on to the farm in a fresh state; but if twenty-four hours are allowed to elapse in warm weather, or forty-eight in cold seasons, before the solid reaches the soil, it is worth less than nothing, for it has, assisted by the bacterial life which it contains, robbed the sewage of a large portion of its fertilizing power. A sewage-farm, to be pecuniarily successful, must have the sewage delivered in a fresh state, before any kind of fæcal fermentation has been established, before the so-called sewage weed shows itself in the running sewage, and before any sooty kind of matter has blackened the liquid. Sewage leavened with this matter, which has been three or four days in some enormous culvert, or some defective sewer, rapidly depreciates in value, just as a piece of the vinegar plant put into the brewer's sweet-wort and allowed to remain for a few hours will effectually prevent his obtaining the alcohol which he expected from his vat. The *sine quâ non* of successful sewage-farming is, therefore, that the sewage be delivered fresh upon the land to which it is sent; this involves a correct form of sewer in the locality which furnishes the sewage.

Secondly, it must be delivered on an intermittent plan. To irrigate a field of forty acres with sewage for several days in succession, to allow the sewage to flood the land, and remain above the soil, so that all air is removed from the soil, for sometimes a week, or even, as I have seen it, for nearly a month at a time, is certain to lead to financial failure, and to seriously diminish the power of the soil to deal with the fertilizing matter contained in the sewage. Sewage does not contain free oxygen. A river into which crude sewage is discharged will lose all evidence of oxygen in its gases, if the volume of the sewage is equal to, say, one-fourth that of the river water. So that when that stage is reached, the fish die for want of air. So also without oxygen in the subsoil of the farm utilization of sewage cannot go on, for the combinations which are required for the continuance of plant growth render oxygen as necessary as it is to animal life. It is true that the function of the plant is to decompose the carbonic acid, and of the nitrogenous juices in the sewage into simpler elements, yet such changes cannot go on without oxygen; and if carbonic acid is too abundant in the subsoil, and oxygen is altogether absent, the vegetable growth is more likely to be damaged than helped, the oxygen set free is not discharged into the subsoil, but in the air above the ground. Sewage must be mixed with oxygen obtained from the atmosphere; as a consequence, therefore, it is most important that sewage application should not be for more than twelve hours at a time in warm seasons, and twenty-four or thirty-six in the colder parts of the year. This sewage must pass over the surface of the soil, and not sink into it more than twelve or eighteen inches deep.

The carriers should not be too wide apart, neither should they be more than three to six or eight inches deep, in their final distribution upon the land; any kind of moveable troughs of wood, sheet-iron, or any other material, are quite out of place, except for the purpose of carrying sewage over a short valley, or over other carriers which may happen to be at the lower level. The carriers should be simple trenches in the ground, the bottom of the trench being slightly above the level of the soil, so that the sewage after passing into the carrier should well over on either side, and run down to the pick-up carrier, which should be parallel to the delivery carrier, but not in close proximity; thus the carrier delivering the sewage will cease one-half or two-thirds of the way down, and the pick-up carrier will commence at the middle, and go on to the bottom of the field, delivering into a deeper cutting in the subsoil at the lower end. The passage of the sewage must be superintended by the waterman, who must watch the delivery, and by stop-boards judiciously placed, keep the sewage spread equally over the soil, and at the end of twelve or twenty-four hours take it off that particular field and place it on another. The first field should be so levelled that it must be completely free from evidence of sewage upon its surface six hours after the water has been taken off. The water should run away by the lower pick-up carrier, and fresh air will then enter the interstices of the soil as the water drains off from the field. It is altogther a mistake to insist upon under-drainage, unless in special portions, in which the water cannot otherwise be cleared away, or where, from narrowness of area, it is requisite to supplement the farm by intermittent downward filtration. It will be found from practice that a well-irrigated land must and will clear itself in the way I have indicated, if the result is to be satisfactory, and no results from other lands ought to be taken count of.

I have seen a considerable number of farms laid out in a mistaken manner to begin with. The carriers delivering the sewage have only emptied themselves of half, or even of only one-third their contents, keeping the lower half, or two-thirds of the carrier, full of sewage in a stagnant state, losing its fertilizing value, and assisting in developing a stink, in positions in which such a thing should be impossible. It is much worse in those carriers which have concrete bottoms, because there is no soakage at all into the soil below. Main carriers should in all cases deliver the sewage on to the field from the lowest part of the semi-cylinder, so that no stagnation should be possible in the carrier itself. It is simply a question of levelling and first outlay. The delivery carrier on the field should allow of soakage in the soil, the main carriers should not. The pick-up carriers will be found, in the course of time, to allow of percolation through their sides, whilst their bottoms will be scarcely pervious to the effluent, which should get rapidly away to the outfall.

There must be no departure from the principles here inculcated, if we are to get a good financial result. Fresh sewage does not smell offensively; it is scarcely colored, certainly not black or opaque, and when delivered it must not be retained in badly constructed carriers. It must not be poured on to the same patch of ground for more than twelve to twenty-four hours at one time, and the effluent must escape from that ground within six or twelve hours of its delivery upon it. Immediately the delivery of sewage upon the patch is stopped, the carrier should run off clear, and be flushed so that no deposit should be allowed to remain at the junctions or within the pen-stocks which are necessary to allow of a command over the distribution. Let these conditions be carried out, it will be utterly impossible for any more mischief to arise from the distribution of sewage than arises in every house when a person uses the water-closet belonging to his own establishment. It takes at least twenty-four hours for mischief to develop from fæcal fermentation, and if that time is not allowed to intervene, and the constituents of the sewage are brought into contact with plant life and the ordinary chemical constituents of agricultural land in the way indicated, no dangers such as Dr. Tidy considers to be necessary parts can possibly come from sewage irrigation. That is the kind of irrigation I advocate, and any other is manifestly wrong.

I now come to the second head, viz.: "The soils best suited for sewage irrigation." Dr. Tidy has misunderstood the object of the operation. That there is an immense advantage in the presence of ferruginous earth upon a sewage-farm, if the object of the managers be simply to purify the effluent, goes without the saying. To purify the sewage has hitherto been the main object of sewage-farm managers, but it ought not to be their primary point. The primary point should be: given so many tons of sewage, containing so many pounds of nitrogen, or so much ammonia, to obtain from the

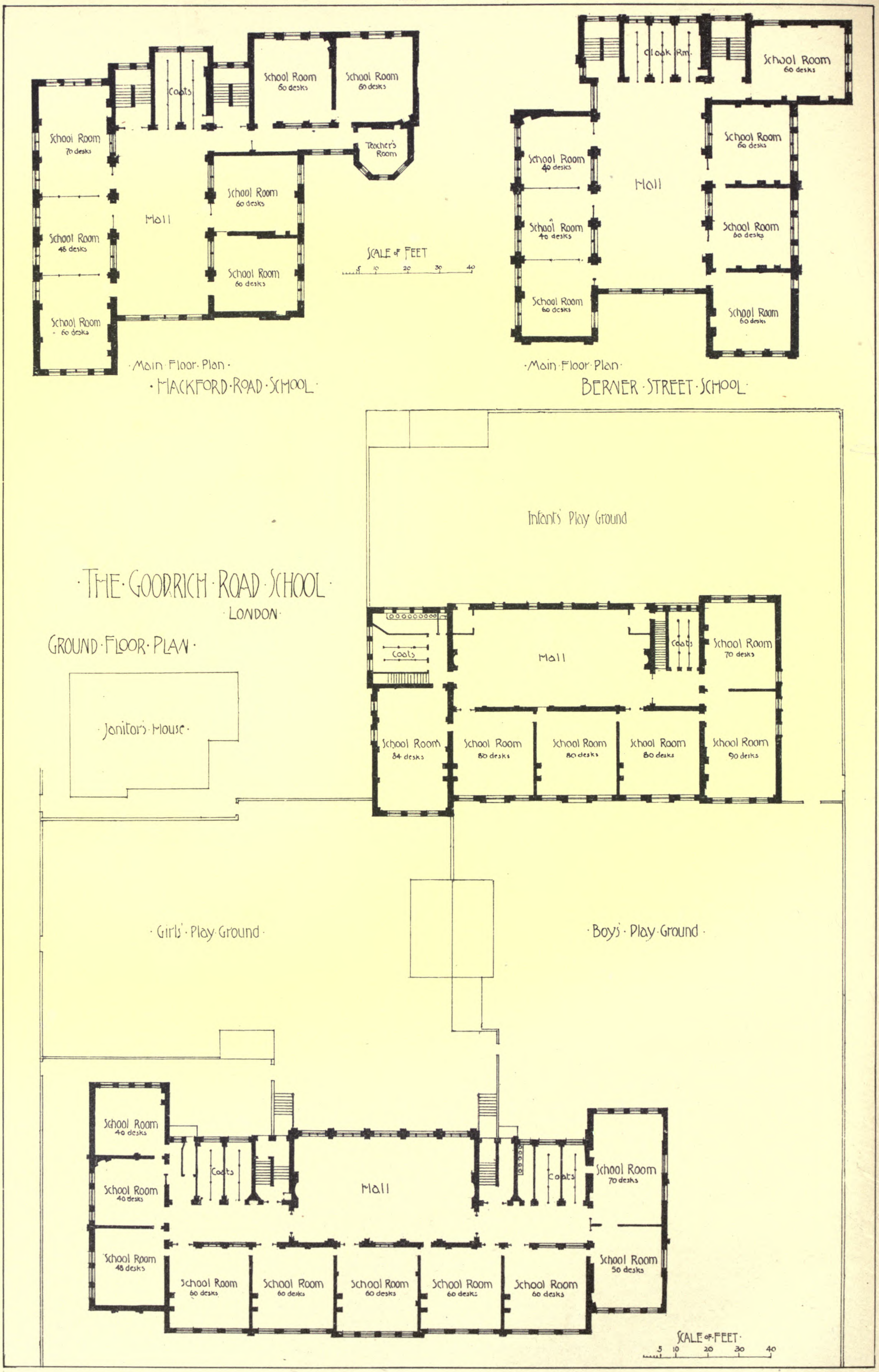
cultivated lands so many tons of produce in exchange. A non-retentive soil, a fine or coarse sand, will require a different kind of cultivation to that which contains a larger proportion of clay. The carriers must be arranged somewhat differently, not be so far apart, and the ground need not be broken up again so frequently as must be the case when an argillaceous soil is at hand. Chalky and marly soils are of great advantage, but they require to be broken up more frequently than sandy soils, if there is to be a large pecuniary result. It is a matter, therefore, of cultivation rather than one of advantage and disadvantage in character of soil. It is not filtration which is to be looked for, not the chemical alteration of sewage products into harmless elements, such as arise when ferruginous earths abound; but the abstraction of the dissolved albumenoid and ammoniacal matters from the sewage itself, and their conversion into vegetable produce at the earliest possible moment. "When the effluent is turbid and discolored" — I use Dr. Tidy's words — the manager may have been at fault in applying the sewage wrongfully. At the same time, I am bound to state that it is utterly impossible to get an effluent which shall be at all times bright and clear. Let an ordinary meadow be flooded with pure water just after a hay crop has been taken from it, and there will be a colored infusion of hay or other vegetable matter flowing from the field, which no art can easily prevent. If the soil has been recently broken up, the first discharge of effluent will be turbid and discolored, but it will be with material which is comparatively harmless, and it is not sewage. Such is also the case after the carriers have been recently cleaned, or if cattle have been trampling on the carriers and chewing the cud in the running stream; but that result does not condemn sewage farming any more than Providence might be condemned because a clear river is made turbid by a thunder-storm. Sewage-farming requires great judgment in application of the dressing. No hard-and-fast line can be given except the one point to which all managers should be obliged to conform, viz., if so many tons of sewage are used upon so many acres of land, let the land be what it may, so many tons of produce should be obtained from that land within twelve months of its application.

Dr. Tidy made a great point of the effects of frost upon sewage utilization. His remarks showed that his imagination had got the better of his experience, or rather that his experience of the effects of frost upon sewage irrigation was absolutely nothing. The sewage, as delivered from a sewer in winter, has a temperature of some 44° or 48°, according to the presence or absence of snow-water in the delivered sewage. I have never found it lower than 44° in temperature, even in severe frosts and after heavy snow-storms. As it flows upon the land, whatever ice or snow may be there is melted, and it spreads over the field even in severe frosts in a perfectly natural manner, just as the River Wandle, near to our town of Croydon, never freezes in even the coldest winter, because the springs which rise in it from the chalk formation are always warmer than the surrounding atmosphere, never falling to a lower temperature than 45° in the coldest winter. The quantity of sewage delivered is also much smaller than in milder weather, and it is probable that the percentage of hot water going into the sewers is also increased. As a consequence, no difficulty is found to exist upon a sewage-farm during frosty weather. If a coating of ice does form upon an irrigated field after irrigation has ceased, the ice protects the rye grass from damage from the cold winds which usually occur at such times. Vegetation goes on below the covering, a considerable portion of the material in the sewage is picked out by the living plant, and a field of young rye grass — after the ice covering has disappeared, and a warm day or two comes to our aid — shows a most wonderful activity. The sewage farmer is able to cut a crop of green food almost before an ordinary farmer has the opportunity of seeing a tuft of young grass in any of his unirrigated meadows. I do not mean to contend that there is no difficulty in frosty seasons. A clay soil is not, then, so advantageous as a sandy soil or a ferruginous earth; but because a temporary difficulty has to be contended with, especially if the area is small compared with the population, that is no reason for condemning the farm; an ordinary farmer is in similar trouble. But if the area be large enough, there is no more difficulty than belongs to a railway in a fog; it is a reason for care, not a reason for condemning the use of the railway altogether. This is the mistaken idea which runs through the major part of Dr. Tidy's attack upon sewage irrigation. Difficulties belong to all scientific operations: they must be guarded against and their effects obviated, and it ought not to be an Englishman's custom to give up the contest if the ultimate result can be shown to be a satisfactory one.

Dr. Tidy asserts that, although the soil may be a purifying agent, it is, to say the least, capricious. That is, Dr. Tidy acknowledges that he does not understand the principles which Dame Nature pursues in dealing with the agricultural use of sewage, and, therefore, he cannot recommend them. The purifying power of a soil is no doubt peculiar. Its peculiarities must be found out, and it will then be found as amenable to management as when an ordinary farmer finds out how much more satisfactorily he can cultivate his soil if he can follow a proper and systematic rotation of crops. The point to be aimed at, therefore, is to calculate the amount of material put on to the surface of the farm; let us say 5,000 tons of sewage per acre per year, this equals 1,200,000 gallons. Let us take Dr. Tidy's value, 1¾*d.* per ton; it becomes necessary to obtain from that acre of land, in the course of the year, about forty tons of produce, either of roots or green crops, and the pecuniary result should not be less than £44 5*s.* upon Dr. Tidy's figures. Any sewage farmer will acknowledge that there is no difficulty in doing this, if the ground is irrigated with fresh sewage. It repeatedly happened, whilst I was superintending the Beddington Sewage-Farm, that some of the least retentive fields were supplied with 10,000 tons of sewage per acre, and our returns from those fields were considerably more than forty tons of produce, nearly double that quantity being obtained sometimes. It is only when the sewage is allowed to stagnate before it gets to the land, or is allowed to go on a particular plot for too long a period at one time, that the results are not satisfactory, for the reasons I have already stated. Dr. Tidy speaks of water-logged areas. The area which took its 10,000 tons of sewage per acre was never in any such condition. The quantity of sewage going on to the land only corresponded with the rainfall as it ordinarily occurs in some parts of our Lake districts, and no one frequenting the Cumberland valleys can fail to see how beautifully the meadows dry themselves after the heavy rainfalls belonging to that locality, without any under drainage; and that the grass of the district is especially satisfactory for stock keeping, never putting on any of that dropsical appearance which Dr. Tidy has portrayed as the habitual produce of an ordinary sewage-farm. It will be seen that in the fields to which I especially referred, each acre of land received the sewage of about one hundred and twenty-five persons; if I take the value of the sewage of each at 5*s.* per head, the amount to be obtained works out to the same figure, viz., about £31 5*s.* per acre. Five crops of rye grass, at an average of 1*s.* per rod per cutting, will produce £40, and I have repeatedly seen forty tons of mangold wurtzel per acre, which has sold at from 18*s.* to 24*s.* per ton, according to the season. When such results follow upon the application of sewage to the land, that land, whatever may be its character, will have the larger portion of nitrogenous matter which the sewage carried to it taken out of it again. It will be utterly impossible for any of those contingencies depicted in such alarming language in Dr. Tidy's paper to show themselves in anything else than in the imagination of the people and those who try to mislead them upon this important subject.

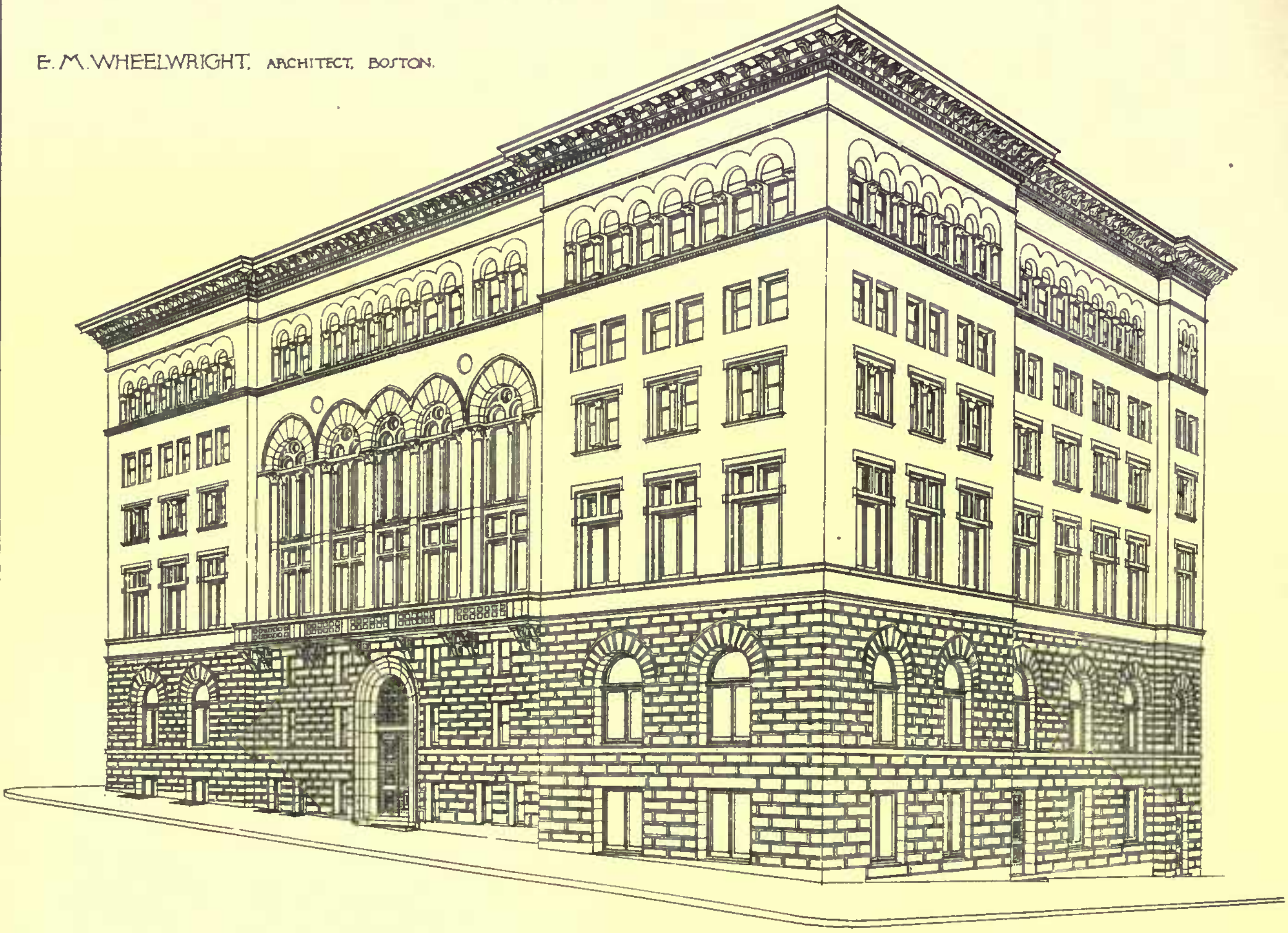
I am obliged to Dr. Tidy for quoting Voelcker's experiments on the action of various solids upon ammonia, especially that part which shows that the weaker the ammonia solution is, the larger the relative quantity of ammonia absorbed; and that the quantity capable of being removed by washing with water is relatively less than that retained by the soil. I take this fact as a strong argument in favor of the application to land of weak sewage, such as town sewage generally is. Such is the application of ammonia to soil which nature provides in an ordinary rainfall, rather than in the form of patent manure, which finds so much more favor with a certain class of chemists, and with the antagonists of sewage-farming. I cannot follow Dr. Tidy, in his statements, based upon Dr. Voelcker's experiments, that the total soluble nitrogen may be found in the effluent as nitrates and nitrites. I cannot conceive it possible that any well-regulated sewage-farm has ever shown an effluent in which the same amount of organic constituents were found as were continued in the sewage, and when chemical examination has shown this, the effluent is not from a sewer farm, unless it be an intermittent filtration area. I do not doubt Dr. Tidy's or Dr. Voelcker's figures, but I doubt the source of the effluent. When a sewage-farm is simply a filter, oxidizing the nitrogen in the sewage, and acting as a strainer for the coarser particles, it is no more a sewage-farm than a town tramway is a railway fit for the "Flying Dutchman" to travel upon. It would be curious, indeed, if our railway engineers were to suggest that, because a splendid engine cannot travel on a metropolitan tramway, therefore railways should be abandoned as dangerous, and unfit for introduction into populous communities. Dr. Tidy gives support to a principle I have advocated for many years, and I take advantage of his chemical knowledge on this subject. I am not a chemist, and I know in that department of the subject I have a safe platform to rest upon in any analysis he may have actually undertaken and published. He says that the composition of irrigated, as compared with non-irrigated soils has been the subject of numerous investigations. The top few inches of an irrigated farm presented marked difference from the underlying soil.

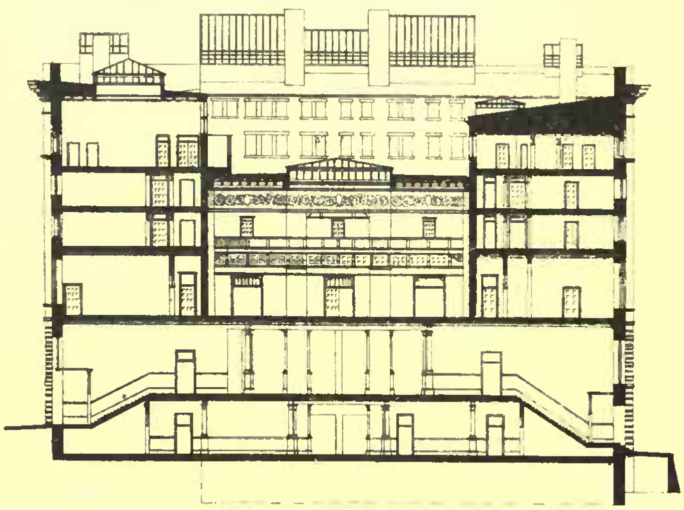
"If, however," says Dr. Tidy, "the top inch of the land be carefully scraped off, the difference in the composition of sewaged and non-sewaged ground will probably be found to be small. At the depth of eighteen inches it is a very rare thing to find any marked alteration of composition. It is certain, therefore, that, given land of ever so suitable a character as a sewage purifier, its powers are not agriculturally those of a storage-battery." My experience coincides with Dr. Tidy's chemical examinations. It is better to provide for the sewage passing over the surface, or for being dealt with near to the surface, than to attempt to underdrain in hopes that the water will be purified and carried off more satisfactorily. No doubt intermittent downward filtration may be of use in confined areas, and during long-continued frosts, for temporary relief, but it is not the primary object which a sewage-farm has in view. We do not want a storage-battery, except in the way described by Dr. Voelcker as the result of the applications of weak solutions of ammonia to ordinary soils, and then only for the darkest parts of the winter season. At other times the soil must be made to deliver up in a rapid manner to vegetable life the nitrogen which has been abstracted from the sewage, whilst, in the warmer seasons of the year, the organic constituents of the sewage should comparatively not come into contact with the soil at all, but should be at once seized upon and


School Room 70 desks
School Room 48 desks
School Room 60 desks
Coats
School Room 60 desks
School Room 60 desks
Teacher's Room
Hall
School Room 60 desks
School Room 60 desks
SCALE of FEET
5 10 20 30 40
·Main·Floor·Plan·
·HACKFORD·ROAD·SCHOOL·
Cloak Rm.
School Room 60 desks
School Room 40 desks
School Room 40 desks
School Room 60 desks
Hall
School Room 60 desks
School Room 60 desks
School Room 60 desks
·Main·Floor·Plan·
BERNER·STREET·SCHOOL·
Infants' Play Ground
·THE·GOODRICH·ROAD·SCHOOL·
·LONDON·
GROUND·FLOOR·PLAN·
·Janitor's·House·
Coats
Hall
Coats
School Room 70 desks
School Room 84 desks
School Room 80 desks
School Room 80 desks
School Room 80 desks
School Room 90 desks
·Girls'·Play·Ground·
·Boys'·Play·Ground·
School Room 40 desks
School Room 40 desks
School Room 48 desks
Coats
Hall
Coats
School Room 70 desks
School Room 50 desks
School Room 60 desks
School Room 60 desks
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School Room 60 desks
School Room 60 desks
SCALE of FEET
5 10 20 30 40

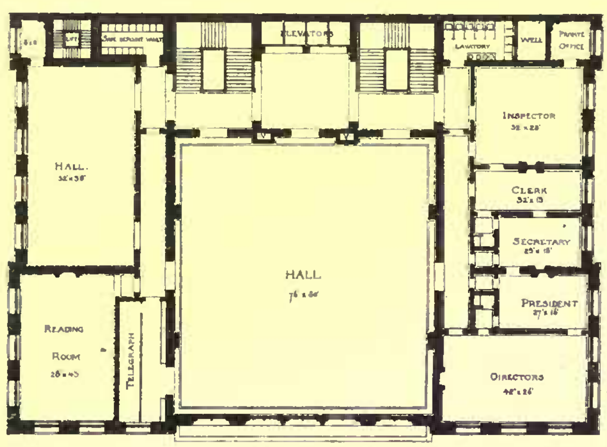
KANSAS CITY EXCHANGE COMPETITION.

E. M. WHEELWRIGHT, ARCHITECT, BOSTON.

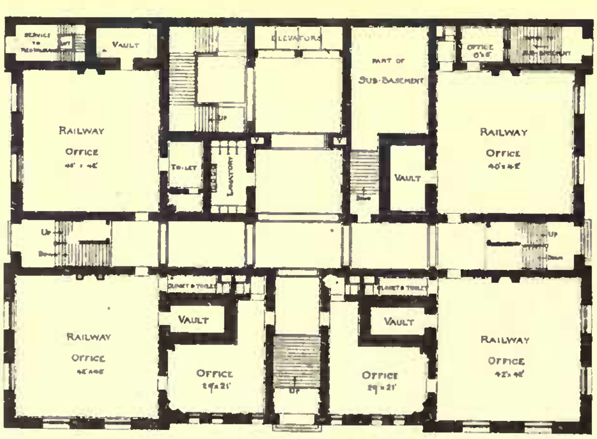




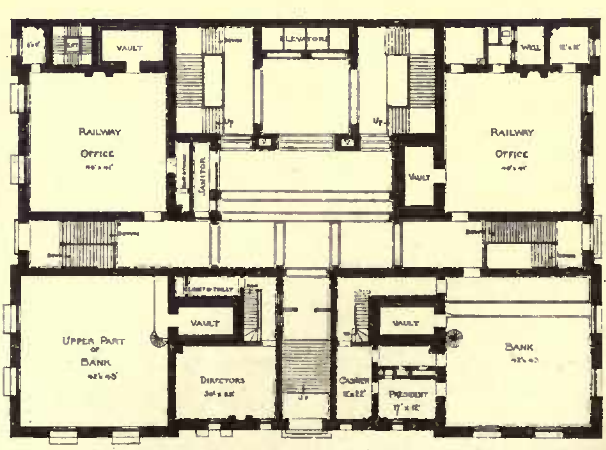
LONGITUDINAL SECTION



SECOND FLOOR

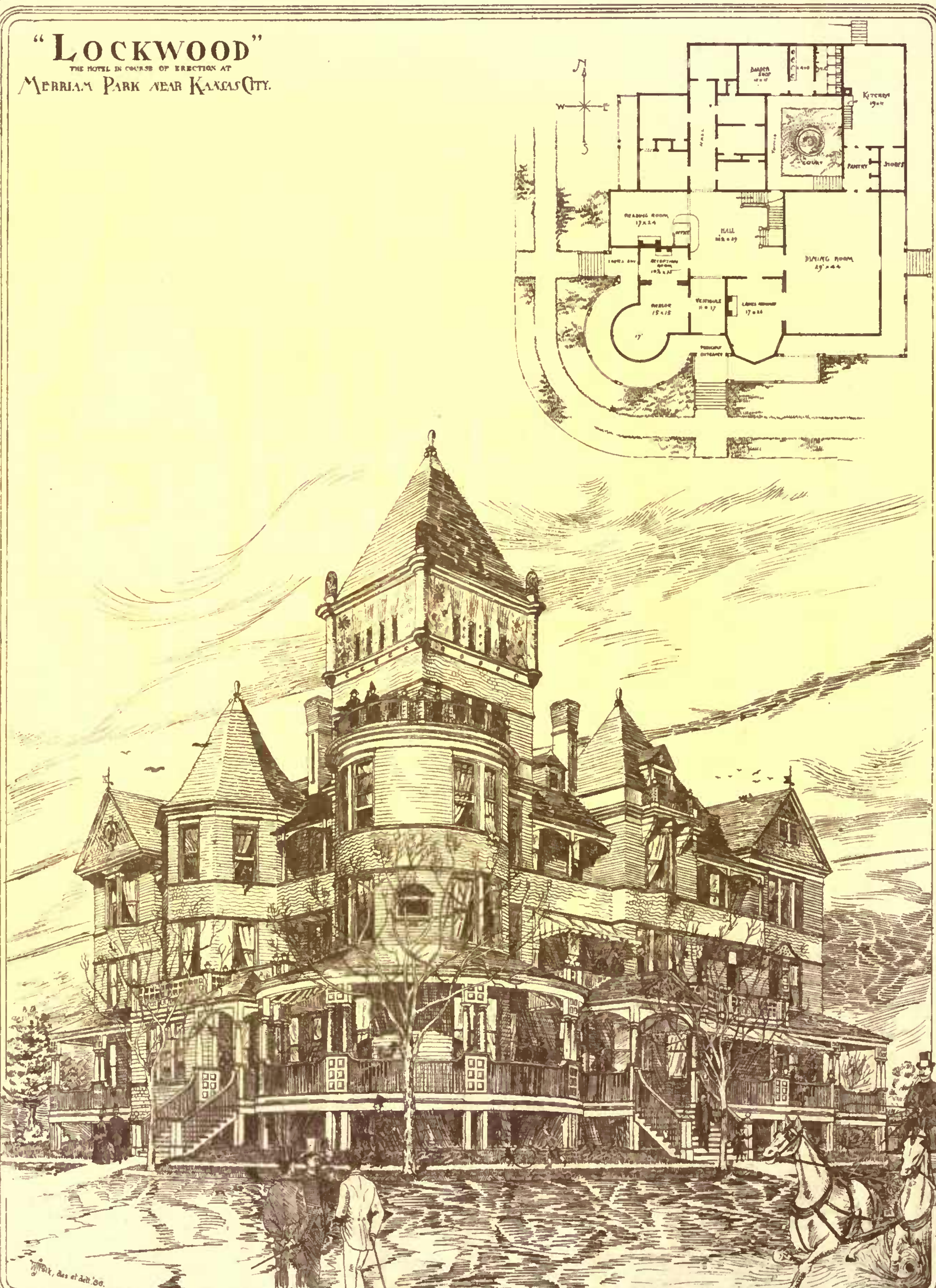


BASEMENT



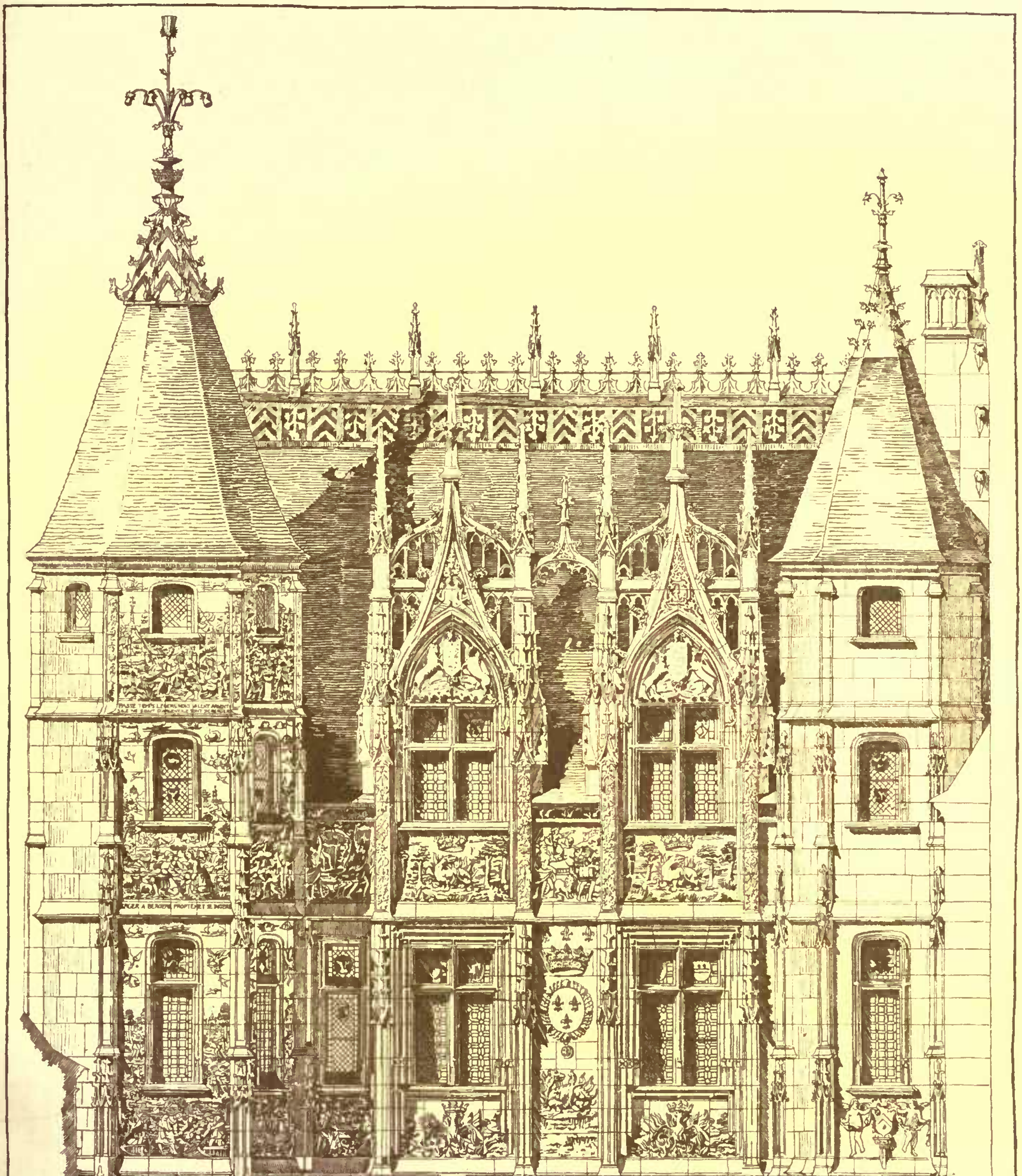
ENTRESOL FIRST FLOOR

"LOCKWOOD"
THE HOTEL IN COURSE OF ERECTION AT
MERRIAM PARK NEAR KANSAS CITY.



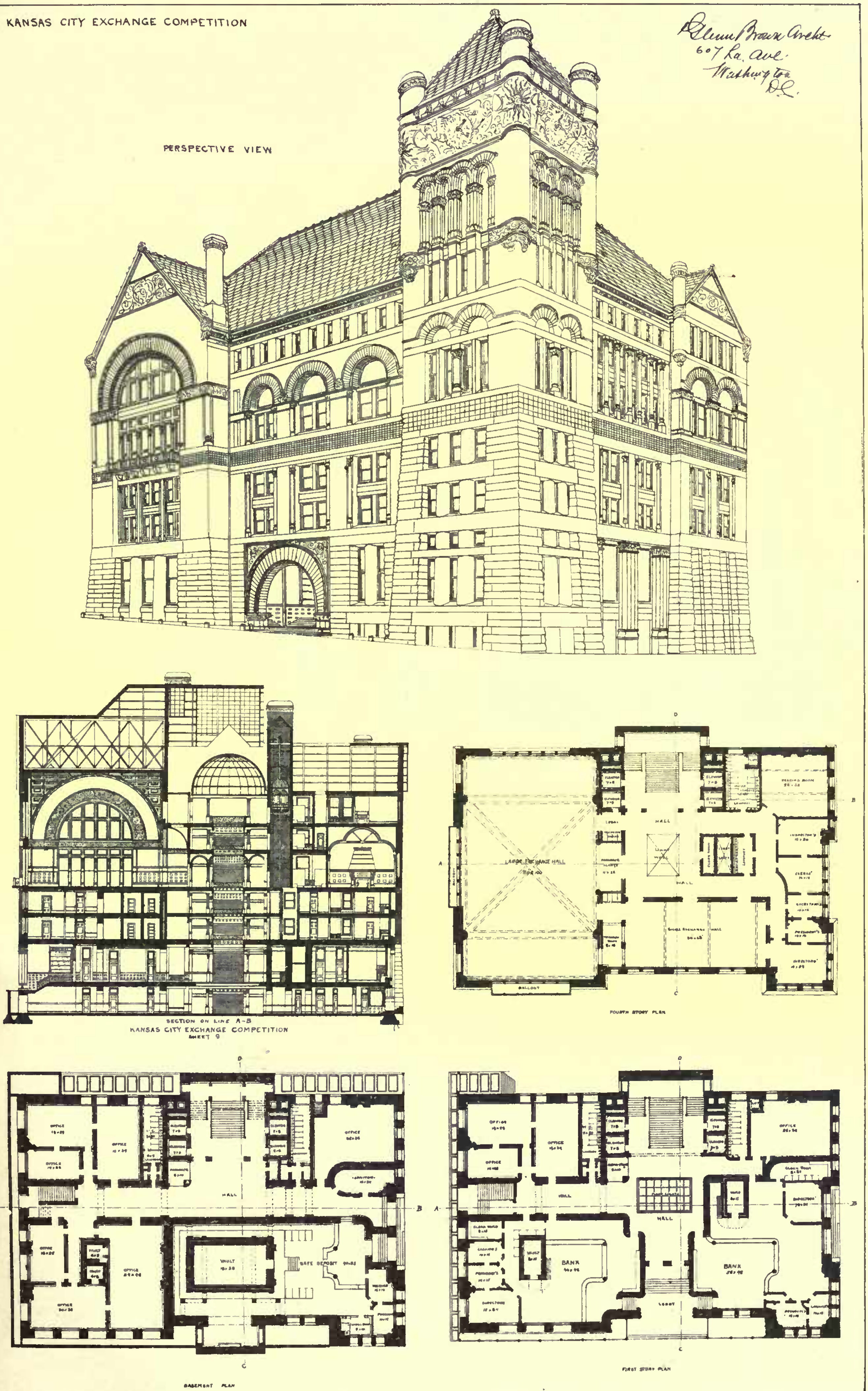
W. W. POLK & SON ARCHITECTS KANSAS CITY

Heliotype Printing Co. Boston.



Hotel Bourgtheroulde. Rouen, France. Facade on the Court-Yard.

KANSAS CITY EXCHANGE COMPETITION





Goodrich Road School London. T.J. Bailey, Arch't



Heliotype Printing Co. Boston

digested by the carnivorous plant, which deals with it as satisfactorily as the anemone deals with organic matter contained in sea-water in the pools of any of our rocky shores.

This brings me to Dr. Tidy's third head, viz., "The crops most suitable for irrigation." Our author does not offer any opinion upon this point; he quots the opinion of others. He says nearly all "agree that the most profitable application of sewage is to pasture land, osiers, and Italian rye grass." He quotes the statements which have been made regarding the fondness of cattle for sewaged grass, and describes cattle as immediately following upon the application of sewage to land, and eating with avidity the grass still wet with sewage. This ought not, and could not be possible on any farm of which the manager knew his duty and understood his work. It is no more argument against sewage-farms than it would be against a railway, because, a gate being left open, the cattle strayed upon the line and were killed.

Dr. Tidy's story of the Aldershot cabbages is only hearsay evidence, and, if true, only showed that the farm manager did not know how to deal with his crop. If he sewaged them a day or two before cutting the cabbages, the story is a possible, nay, even a probable one, for the outside leaves would be soaked with sewage-water. But cabbages or roots ought not to be sewaged for at least a month before the crop is ready for gathering, and no rye grass should be sewaged for at least a week before it is ready for cutting; then the conditions described could not come to pass.

[To be continued.]

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE OF A. E. TOUZALIN, ESQ., MILTON, MASS. MR. W. R. EMERSON, ARCHITECT, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial Edition.]

GOODRICH-ROAD SCHOOL, LONDON, ENGLAND. MR. T. J. BAILEY, ARCHITECT.

LOCKWOOD HOUSE, MERRIAM PARK, NEAR KANSAS CITY, MO. MESSRS. W. W. POLK & SON, ARCHITECTS, KANSAS CITY, MO.

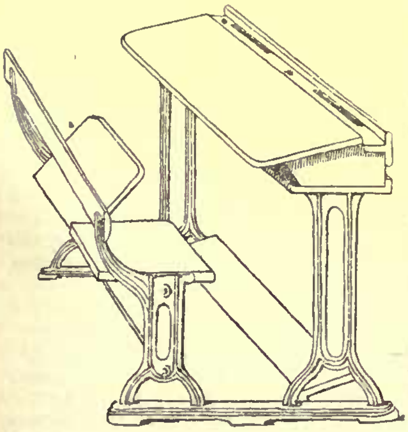
Estimated cost, $30,000. To be completed by July, 1887.

HOTEL BOURGTHEROULDE, ROUEN, FRANCE.

COMPETITIVE DESIGN FOR THE KANSAS CITY EXCHANGE. MR. E. M. WHEELWRIGHT, ARCHITECT, BOSTON, MASS.

COMPETITIVE DESIGN FOR THE KANSAS CITY EXCHANGE. MR. GLENN BROWN, ARCHITECT, WASHINGTON, D. C.

THE LONDON BOARD SCHOOLS.



THE thoroughness with which municipal matters are regulated and administered in London is abundantly illustrated by the public primary schools. Certainly, so far as concerns systematic planning on lines constantly adhered to, and careful, conscientious supervision, both of the buildings and the pupils, the London schools leave nothing to be desired, and in some respects they are superior to anything of the kind anywhere else in the world. A great share of this excellence is due to the manner in which the London schools have been cared for during the past fifty years. At the beginning of the present century, nearly, if not quite all of the schools were under direct religious supervision — in no sense what we would call free schools, each parish being supposed to care for its own children as the vestrymen saw fit. There arose, as a consequence, a very confused condition of school affairs, and a great inequality in the relative facilities for primary education. The English, like their neighbors across the Channel, have never fully accepted the true spirit and intent of public schools. Even now the respectable middle-class tradesman sends his boy to a public school only because he cannot afford a private tutor, and the notion that the very promiscuousness of the public school gives it an additional educational value has entered but slowly into the average British mind. But a decided advance has been made from the inadequately equipped parochial school. The London public schools are now under the direction of a single Board, whose jurisdiction extends over not only the City proper, but over the whole of the London Metropolitan District. In many of the parishes the old schools still exist, under more or less modified conditions, but in every district the Board has established its schools with most satisfactory results.

At first the Board employed various architects to plan and build the school-houses, but after a few years' experience it was found better in every way to place all of the architectural work in the hands of a single architect, and the result has amply demonstrated the wisdom of the decision. Edward Robert Robson, F. R. I. B. A., was the first architect of the School Board, and upon his resignation, a few years since, Mr. T. J. Bailey, the present incumbent, succeeded him. Few realize how many school-buildings there are in a city like London. Without going any further into mere statistics, it will suffice to say that Mr. Bailey has constantly from twenty to thirty school-houses in course of construction, and there is every evidence that new buildings will be required at the same rate for many years to come. With so much experience to profit by, and so many opportunities for ascertaining by actual trial the exact conditions under which a school-house or a class-room is most successful, it will readily be appreciated that some very tangible solutions of the problems have been worked out, and that some of the facts about school architecture have been determined with more exactness than could be expected from the conditions existing in any other city.

In considering these Board schools, it must be borne in mind that they are strictly primary schools, receiving children from about six to thirteen years of age. The London public school system apparently does not include what we might term the upper grades of the grammar schools, still less anything like our public high schools. Also, by provision of the school laws, the head-master of each school is more than a mere superintendent; being required to take an active share in direct instruction, and to have personal direction of each class-room. Consequently the plan which has been worked out in the United States, of a number of distinct class-rooms united only by the common hallway, would be impracticable for English needs, as affording no opportunity for the immediate general supervision which is felt to be needed.

Perhaps the best example of the typical London Board school, in its most complete development, is the Goodrich Road school, a plan of which is given in this issue. As this was erected in an outlying district, where land was easily obtained and comparatively cheap, the building spreads out over more ground than most of the schools in the more thickly-settled districts, and it will be noticed that the youngest children, the infants, have a building to themselves, with play-ground, etc., quite distinct from those of the more advanced pupils. The infant school has two entrances, through vestibules, into a hall, sixty-one feet six inches by thirty feet six inches, open to the roof and lighted from one side. Adjoining each end of the hall are the cloak-rooms and lavatories, and the narrow stairs leading to teachers' private rooms in a half-story over the cloak-rooms, while opening as directly from the central hall as possible are six school-rooms, with desks and seats for three hundred and eighty-four children. It is intended, however, to receive only three hundred pupils, as the single large room at the left is generally used only for special exercises. The hall apparently serves for a little of everything. It is the superintendent's office, whence he can look directly into any of the school-rooms; it is in part his room for recitations, and it affords an excellent field for indoor calisthenics, exhibitions, etc. This large central hall is a feature common to all of the Board schools, and almost peculiar to them alone, as nowhere else has it been adopted so extensively and proved so acceptable.

The hall is heated only by four gas-water heaters, and the school-rooms by fireplaces fitted with Boyd grates. Ventilation in the hall is effected by the aid of long valves in the ridge of the roof, and in the school-room by flues in the wall.

The larger building for the advanced classes has much the same general scheme. The boys occupy the first floor, the girls the second, with separate entrances for each. The central hall is thirty-four by fifty-seven feet. On each side are the stairs; beyond these the cloak-rooms and lavatories, and the ten school-rooms are arranged as close to the hall as possible. The corridors at each end of the hall are twelve feet wide. The teachers' private rooms are in half-stories over the lavatories. The first and second stories are practically the same in plan, part of the attic space being used as a large drawing-room. The school-rooms have desks and seats for five hundred and forty-eight pupils on each floor.

It will be seen by the plan that a very liberal allowance has been made in the way of play-grounds. The school laws require that the site for a school-house shall contain not less than 10,800 square feet of land. In this instance the boys and girls have two open play-grounds of 22,000 square feet, and the infants one of 9,000 square feet, exclusive of the space covered by the buildings. The play-grounds are thoroughly drained and paved with asphalt. There is a covered shed in each, for rainy days, and a fair allowance of swings, trapezes, parallel-bars, etc., to enable the pupils to work off their surplus energies during the intermissions.

Plans of two other Board schools are also given, neither of which, however, is as simply planned nor as liberally endowed with room as the first example. The Hackford Road school is in three stories, the infants occupying the first, the boys the second, and the girls the third. The accommodation is for four hundred and eighteen on each floor. The plan has the disadvantage of some of the rooms being rather far removed from the central hall; otherwise it is very compact in arrangement, and a more economical plan for the accommodation

than the Goodrich Road school. The same might be said of the Berner Street school, which accommodates three hundred and eighty pupils on each floor. The latter example presents a peculiarity of arrangement not found in either of the others. Berner Street is in a very crowded locality, where it was found to be impossible to obtain sufficient extra land for the play-grounds. Accordingly the roof over the greater portion of the building was made flat, paved with asphalt, surrounded by a high brick parapet, and used as an open-air play-ground.

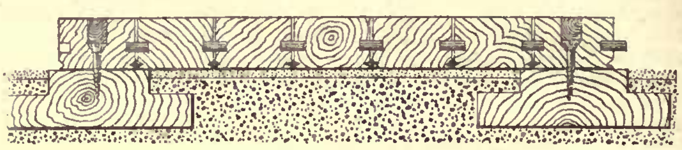
These three buildings represent the present architectural sentiment of the London School Board, if such an expression may be allowed. The older schools are generally quite different in arrangement, and by no means as good; indeed, looking at the plans of the schools in the order in which they were created, it is quite easy to trace the gradual development from a confused, indefinite scheme to the simple well-chosen type represented by the Goodrich Road school. Each successive school building has been an advance over its predecessor; a little more truly the ideal arrangement; a little better fitted for its purpose. That this progress is largely due to the wise policy which placed all the schools in the hands of a single, well-trained architect there can be no doubt; and though the perfected plan might not recommend itself as most suitable for our own wants and systems, it leaves little to be desired by the London teachers.

The details of planning and construction of the Board schools are quite as carefully considered as the general scheme. Many of the usages which, at first, were hardly more than experiments, have passed into the rules of the Board as law. The amount of money placed at the disposal of the architect is limited to ten pounds for each pupil accommodated, and it has been found that many schools have been built for eight pounds per head or even less. The actual cost of the Goodrich Road school was eight and a half cents per cubic foot, which, as nearly as can be approximated from the fragmentary documents available, equals about eleven pounds and a fraction per pupil; but few of the schools have been planned on so liberal a scale. The height of stories is fixed at fourteen feet in the clear for all class or school rooms. Eight square feet or eighty cubic feet is the minimum allowance for each infant, and ten square feet for each adult. Twenty-two to twenty-six feet have been found to be the greatest practicable width for the school-room, and the rooms are generally made of sufficient depth to allow at least eleven feet of clear space in front of the desks. The rooms are invariably arranged so that the pupils shall sit with the light on the left, and it is assumed that the area of window-surface required is approximately thirty square inches for each square foot of floor, though this is, of course, only a rude rule-of-thumb, and in practice is often exceeded. The windows are kept well up from the floor, often as high as four feet, but are carried as close to the ceiling line as is possible, experience having shown that a high window lights much better than a low one of the same dimensions. North light seems to be preferred for the lighting of the school-rooms, leaving the sunny side of the building for the large central hall.

For heating the school-rooms the only provision is in the shape of fireplaces with some heat-saving appliance, generally the Boyd pattern, where fresh air is led from out-of-doors to an iron heating-chamber built about the fireplace, and thence delivered in a heated condition immediately under the mantel-shelf, on essentially the same principle as the Jackson grate, so well known in this country. The halls, corridors, and cloak-rooms are heated by hot water. The normal temperature of the school-room is 65°.

Considerable attention is of necessity given to the arrangement of the stairs. The steps are of stone in single blocks, and the stairways are always enclosed by brick walls, the double flights being separated by an eight-inch wall, so that there is no open well. A stout, round hand-rail is put against the walls on each side. The stairs are restricted to five feet as a maximum width, but are more often three-and-a-half to four feet wide. A greater width is believed to simply increase the danger of the pupils falling, and for a greater number of pupils, additional stairways, rather than wider ones are thought best. On the other hand, the wider the landings the better for the safety and convenience of the pupils, and these are accordingly made quite wide and extended across both runs of the stairs, without any winders or intermediate steps, and all landings are well lighted. Furthermore, following out the same idea of guarding against anything like an accident, the stairs are laid out with a six inch rise, and only eight steps are allowed to a run. This increases considerably the space devoted to the stairs in a building, but the precautions are all wise ones and should never be neglected in any school building. One is so prone to think that a large building calls for a large staircase, that it does not at once appear how much better it is in every way to have two stairways five feet wide, than one ten feet wide.

The finished floors in the school-rooms are of hard pine boards laid in the ordinary manner, but in the large central halls and corridors something else was found necessary in order to properly deaden any sound which might be transmitted to the story below. The system adopted is worthy of special notice. Iron floor-beams are used, between which are turned-brick arches, levelled up over the entire area by a bed of concrete. At intervals of about two feet each way, square, rebated blocks of wood are bedded in the concrete, flush with the surface, and over all the finished flooring is laid, composed of wooden blocks two inches thick and about two and a half by six inches on the face. These are laid herring-bone fashion, united to each other by iron dowell pins or plugs, and bedded in hot asphalt which runs up in a groove cut on the lower edge of each



block, binding the whole solidly to the concrete foundation, while as an additional security the flooring is screwed to the blocks bedded in the concrete. The adjoining section will illustrate this system which is patented under the name of "Duffy's Immovable Acme Wood Block Flooring."

The walls of the school-rooms are finished inside with brick, usually a common brick, carefully culled and painted some dull color. The ceilings are plastered and left white. In the central halls only is there ever anything like interior decoration. Everywhere else the rooms are kept perfectly simple, as befits their character, but cheerful and tidy looking and full of light. The finish is preferrably of yellow pine left its natural color and varnished. It seems to be a rule of the Board never to allow a dark corner to exist anywhere. The doors have glazed upper panels, partly for light, but more to permit of ready inspection on the part of the superintendent; and all doors, both inside and out, are required by law to have fittings permitting them to swing both ways. Each school is generally arranged so that between two of the largest school-rooms there may be a wide, glazed, sliding-door or partition which can be pushed back easily if the space is desired for larger classes or special examinations.

As regards the arrangements for seating the pupils, it has been found that neither single desks nor continuous forms gave the best results, but that both for infants and adults double desks, three feet four inches wide were most satisfactory. These are arranged in rows, rarely more than five deep, with an aisle sixteen inches wide between the rows. After many trials the Board has adopted what is known as the "Clark Automatic Seat Desk," shown in the initial cut, and this form is used in all the more-recently constructed school-buildings. The desks are made in three heights, twenty-five, twenty-nine-and-a-half, and thirty-two-and-a-half inches. The seat and desk are fastened together by the iron foot-pieces, as shown by the drawing, but are not secured to the floor. In most of the rooms the rear row, and occasionally the two rear rows, are stepped up four inches above the rest.

Each story is provided with a certain number of wash-bowls, but all water-closets and urinals for the use of the pupils are arranged in a separate building having no connection with the school and entered only from the play-grounds. Each of the private rooms for the teachers has a small, portable range for cooking a light dinner, or making tea, a convenience hardly thought of with us. Also, in each district there is at least one school-building which has an annex, usually incorporated with the janitor's lodgings, where regular instruction is given in cookery.

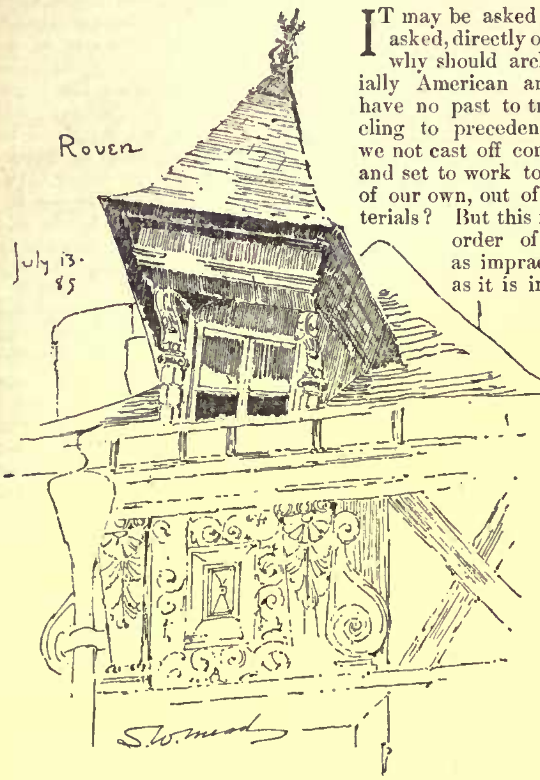
There are many other features of the London Board schools which are of more or less local interest, but which hardly come within the province of the present paper. The key-note in everything is simplicity, whether in planning, construction, or the more æsthetic considerations of external adornment; and, after all, the simplest things are generally the safest, and are apt to be the most satisfactory in the end.

The drawings accompanying this article were copied directly from the documents of the School Board, through the courtesy of Mr. Bailey, to whom, and to whose inspector, Mr. Frederic Warren the writer, is indebted for aid in personal investigations of the existlng school-buildings.

THE BUILDING TRADE IN LONDON. — The London *Building Society News* of the 1st ult. publishes the following table showing the actual growth of "greater London" in population and houses during the last fifteen years. It argues that the remarkable activity of the building trade from 1879 to 1883 was chiefly due to the building-association boom which characterized those years and was at its height in 1881. The City of London is excluded from both tables, as there has been no vacant land within it for many years; hence, the figures, both as to population and houses, relate solely to the suburbs of, and additions to, the largest city in the world:

Years.	Population.	Houses required.	Houses built.
1871	3,810,744		8,693
1872	3,877,813	8,609	11,179
1873	3,946,062	8,761	7,687
1874	4,015,512	8,915	7,764
1875	4,086,185	9,072	10,023
1876	4,158,101	9,231	12,938
1877	4,231,283	9,394	14,410
1878	4,305,753	9,559	17,127
1879	4,381,534	9,728	21,589
1880	4,458,648	9,899	24,945
1881	4,716,009	10,010	26,170
1882	4,797,595	10,255	23,301
1883	4,880,593	10,573	21,110
1884	4,965,027	10,883	18,428
1885	5,050,921	10,941	15,754

THE COURSE OF AMERICAN ARCHITECTURE.[1]



IT may be asked — it is often asked, directly or implicitly — why should architects, especially American architects, who have no past to trammel them, cling to precedent? Why do we not cast off conventionalism, and set to work to form a style of our own, out of our own materials? But this is against the order of nature, and as impracticable in art as it is in science. It would be no more preposterous to set out to develop geometry anew from the start, avoiding the Pythagorean Proposition and the rest of the geometer's elements, than to create an architecture by ignoring the styles that have gone before. The thing was done, *ab initio*, before the beginning of history, and it took thousands of years to develop a tolerable architecture. Continuity is the condition of success and of progress in this, as in every other line of human endeavor. Every great architecture has been the fruit of persistent effort by many generations laboring to perfect the same forms. It took two hundred and fifty years to advance from the Doric style, as it appears in the oldest temples at Selinus, to its perfection, as we see it in the Theseum and the Parthenon. The evolution of the finished Gothic of the thirteenth century had required two centuries of a multitudinous effort to which our modern building activities are child's play. Architecture languished in unskilled hands between these periods; but the continuity of its development was never broken through all the range of history till the time of the Renaissance, and then only to take a new grip of the old line farther back.

It has been argued that the only architecture possible to us now is eclectic. Perhaps this is true. We have already tried it freely. But, unfortunately, eclectic design, while it looks temptingly easy, and so is the natural recourse of the undisciplined, is extremely difficult, perhaps the most difficult of all design. Men of small acquirement may work safely in a formed style, but such men are eclectic at their peril. It takes much knowledge, a keen and sensitive eye, to search out among various examples the forms which have natural affinities. It takes a great deal of skill to add the delicate adjustments, the modifications, slight, perhaps, but indispensable, which are needed to make them fit happily together. The eclecticism to which we are used is like the packing of beech nuts into chestnut burrs. And the fatal weakness of eclectic skill is that it does not propagate itself, as does the power of a finished style. It takes long to acquire it, and, once acquired, it is an individual faculty which dies with its possessor. Nor is it cumulative. Every man's line of progress is his own; what he accomplishes does not ally itself with what his neighbor is doing. The result, as we see it, is in most individual cases failure, and in the mass confusion. The only eclecticism which can lead to permanent good is one in which architects shall come to agreement as to what forms they shall select, and set to work in common to shape these selections into an harmonious whole. But the moment this happens eclecticism is crystallized into development, and ceases to be eclectic. . . .

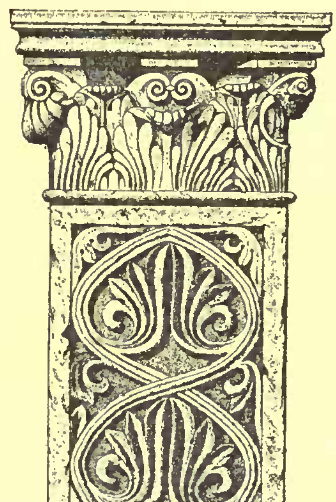
It is in city architecture that we fail most. The good effect of this depends much less on the quality of design of its individual buildings than on the breadth, harmony and repose, the continuity of surface and sweep of line, that are got by their association. Of these best qualities our recent building shows hardly a trace. Our street frontages are sliced up into pitifully narrow lots. Every man builds to suit himself alone, and the houses, to use the slang of the French studios, are all swearing at each other. Their tumultuous architecture, as a whole, has scarcely more artistic effect than the strings of cabs, carts, wagons, and horse-cars that struggle through them. If we walk through the new streets of one of our wealthy cities — Boston, for instance — we see handsome façades, rich and often delicate in detail, and even in general design, and we think our building has improved wonderfully in a generation. Perhaps we compare it complacently with the street architecture of a dull city like London. But we cast our eyes down the length of the street, and the impression is gone; the elbowing façades, discordant lines, and broken colors pervert the whole effect not only to confusion, but to absolute meanness. We could sigh for the broad surfaces and swinging lines which excuse the paltry monotony of Regent Street and its Quadrant, to say nothing of the splendid vistas of the avenues of Paris. Really, the best *ensembles* are in those older streets where building contractors have built whole blocks in uniform — poverty-stricken in design, but borrowing breadth and the dignity of repose from their union. So a well-drilled regiment of even shabbily-uniformed soldiers will make a better show on parade than a crowd of gentlemen in fancy dresses — and our streets are always on parade. . . .

Yet the real value of Mr. Richardson's example lay not in the style he chose, but in the use he made of it; and the thing which commended the style to him was doubtless its adaptability to the qualities of design at which he aimed. Though the power of the man is incommunicable, the qualities of breadth, subordination, simplicity and repose which he put into his work have made themselves felt, and have been reproduced by his followers in their degree. His style can be copied, and it must be greatly perverted from his use of it before these embodied virtues of his can be eliminated from it. Wherever it prevails it extinguishes the fantastic as a rising tide puts out fire. Mr. Richardson's career is in itself an invaluable example of conviction and steadfastness, of an unflagging effort to express certain high qualities of design, which we have, for the most part neglected, in a language which he persisted in mastering, and which he never changed after he had found it. Many, whom his conviction has not reached, make haste to imitate his manner. The drawback is that this new departure, like the rest, comes as a fashion; the inevitable question is: When will it go as a fashion, and what will take its place? . . .

If we ever get any architecture that is consistent and lasting, it will be national enough for the wants of those who like to set their pride of country on so small a pedestal as mere national peculiarities. But it is more important that it be good; and where are we to look for the unity and steadfastness without which no nation ever attained excellence? Shall we have to write of our architecture as Jacob said of Reuben, "Unstable as water, thou shalt not excel"?

[1] Extracts from a paper by W. P. P. Longfellow, architect, in the *New Princeton Review*.

THE WELSBACH INCANDESCENT GAS-BURNER.


FROM REVOIL'S ARCHITECTURE ROMANE

THE production of light for illuminating purposes by the incandescence of a refractory material, has been the cherished object of many inventors, some of whom have so far developed their ideas as to have brought them more or less successfully from the laboratory into the market. The Clamond, Popp, Lewis,[2] and more recently the Lowe and the Auer von Welsbach systems, are those of which we have heard the most, and which have found a more or less extended practical application. This last-named has been for a considerable time tested on a large scale in Vienna, and is now being somewhat tardily brought to the notice of the public in England. Before Auer von Welsbach, a Viennese scientist, discovered the way to utilize one of the most refractory of known materials — zirconia — highly resistant earths and metals had been employed. Thus the Clamond system comprises the use of magnesia, either in filaments, slabs or pencils, against which the intense heat produced by a modified Bunsen burner is projected. Popp, Lewis and Lowe, on the other hand, employ a cage of platinum, but in each of the two typical systems, gas and air have to be supplied to the burner at exceptional pressures, involving special arrangements which complicate the processes and limit the range of their applications. With water-gas such special arrangements are unnecessary, and we believe that at many factories in Germany, where water-gas is made use of, the Clamond system is found to give satisfactory results. The pencils of magnesia, however, require very frequent renewal, and although the cost thus incurred is insignificant, the comparatively short duration of the incandescent material

[2] See *Engineering*, vol. xxxiv, pp. 43, 119 and 601.

presents a great difficulty. In those systems, also, where cages of platinum wire are employed, the same objection applies with greater force, for not only does the platinum soften and absorb carbon under the continued action of intense heat, but the color of the light is not good, and the cost of renewal is relatively heavy.

The system of Professor Auer is one of extreme beauty and ingenuity. He extracts by a complicated chemical process the metal zirconia from one or other of the several zircon ores found in nature, and combines it in solution with solutions of lanthanum, and one or more other rare and refractory metals, to obtain the basis on which his incandescent light depends. With the fluid thus produced he impregnates a hood of finely-woven fabric, which, when dry, is suspended over a Bunsen burner and ignited; the combustible fabric is burnt away, the water of the solution evaporated, and there remain a delicate, an extremely delicate, zirconian counterpart of the original fabric, shrunk, of course, but perfect in every mesh. Prior to impregnation, the top of the hood is secured by a fine platinum wire, which subsequently serves as a means of support, it being attached to a stem placed in the fittings of the lamp. The burner employed is of the Bunsen type, modified by an old and well-known device, so that it can be turned down without "lighting back," and the heat thus obtained, without any augmentation of pressure, is sufficient to bring the zirconia skeleton to a state of brilliant white incandescence, the luminous energy of the gas consumed in this way being considerably higher than when burnt in the most economical gas-burner. As much as seven or eight candles per foot of gas burnt per hour can be obtained, though probably this is considerably higher than the average that would be given. There being no flame, the light is absolutely steady.

An installation of Welsbach burners has been erected at the Marlborough Gallery of Paintings, 53, Pall Mall, S. W., and awakens the admiration of all who see it, both for the absolute steadiness of the light and for the beautiful quality of the illumination, which has a tone intermediate between that of an electric incandescence and an arc lamp. All the shades of green and blue in the paintings hung on the walls of the gallery come out with perfect accuracy, and it only needs the substitution of another source of light to render evident the great difference between gas burned under the Welsbach system and any other in vogue in this country. Fifty-six burners are arranged in two rows along the centre of the room, and provide an illumination which is perfectly steady and noiseless, free from all dirt and smoke, and far less heating than usual, since little more than only one-third the ordinary quantity of gas per unit of light is consumed.

The burners at the Marlborough Gallery are, we believe, of Austrian manufacture, but their production in this country is being attempted. Those we are describing are formed of a Bunsen burner having a gas-jet on the principle of the watering-rose, that is, with a number of small holes through which the gas is emitted in fine streams, which mingle with air entering the mixing-tube at the sides, in the usual manner. This arrangement gives a short flame of great heat, and one which is quite free from all hissing sound. The gas burns at the outlet of the mixing-tube, within a hood or mantle formed of zirconia, as already described. This hood is made originally from hosiery fabric in the form of a tube, and is supported by a ring of platinum wire at its upper end. The tube is first doubled on itself, and then the wire is sewn into it, thus securing the hem, and forming a means of attachment. By the aid of two extensions, the wire ring thus formed is secured to a support, and the hood is held over the flame. According to another method of manufacture devised by Mr. A. Paget, of Loughborough, the hoods are each made separately on a hosiery frame, and are provided with a channel, such as ladies call a string-case, at the upper edge. The platinum wire is threaded through this channel, and is provided with a cross-loop, like a bucket-handle, by which the hood can be suspended from a hook. This arrangement gives a neat appearance to the hood, and causes the shrinkage to take place in a more symmetrical manner, avoiding plaits which may ultimately become sources of weakness, owing to unequal temperature.

As the hood, after its incineration, is extremely fragile, it is necessary that it shall be protected as far as possible from the dangers of transport and handling. For this purpose, the attachment, from which it is suspended, is fixed to a gallery which forms the base of the chimney, and the three constitute a compact piece which can be moved safely. The hood cannot be unintentionally removed from the inside of the chimney, and the presence of the glass insures that reasonable care will be exercised in handling, even by ignorant servants. In connection with the gallery, which slides over the mixing-tube of the burner, there is a grid, which fits on the tube, and prevents the flame striking back when the gas-supply is reduced.

Experiments made on Monday last showed that with a consumption of 2.4 cubic feet of gas, at a pressure of .9 inch to 1 inch of water, an illumination of 18 standard candles was obtained, or an efficiency of 7.5 candles per cubic foot of gas. It is needless to say that this is a most successful result, and that if considerations of economy of consumption were the sole elements in the relation of gas-burners, the Welsbach light must supersede all others. The question of the durability of the hood has, however, to be taken into account. Considering the very delicate nature of this part, which must not be subjected to rough usage of any kind, it is probable that in ordinary use comparatively few will perish of old age, but will be destroyed by accident. Laboratory experiments, however, show a duration of one thousand hours, with but little reduction in the light-giving qualities, and we believe that two thousand hours have been reached without remarkable deterioration. It is evident that if limits like these could be approached as an average, the cost of renewals would be insignificant, and the trouble involved inappreciable. But it is not likely that in common use, where the delicate film is exposed to careless and ignorant handling, and to all the thousand and one shocks of every-day life and work, that great longevity will be reached, and the item of cost and trouble may then enter as important factors in the equation of real usefulness. On the other hand, there is a large margin in economized gas; fifty per cent is not too high an estimate, and this saving will balance damaged hoods and tired patience to a large extent, while an absolutely pure and steady light, a reduction, in proportion to that of the gas consumed, in vitiated atmospheres, are no small advantages.

We believe that the Auer von Welsbach system has an extended field of usefulness before it, and that it will grow rapidly in favor in places where sufficient gas is burned to render it worth while for some one with a capacity beyond that of domestic servants, to take charge of the fittings, and until it is challenged by some robuster and equally efficient rival, which will defy the destructive finger of the British housemaid. The Welsbach system, with an actually, not relatively, strong hood, would be practically perfect; it is for those interested in the question to arrive at this desideratum, and unless they can do so, they can scarcely hope to hold a monopoly in gas-lighting by incandescence, which promises to be, for a time, at least, the "light of the future." — *Engineering.*

SOCIETIES

THE LATE SIR JOSEPH WHITWORTH.

At the meeting of the Engineers' Club, of Philadelphia, held February 19th, Mr. John Fernie, C. E., Member Institution of Civil Engineers, Institution of Mechanical Engineers, etc., of England, delivered a most entertaining and instructive address upon "The Mechanical Genius and Works of the Late Sir Joseph Whitworth."

"Full of years, of honors, of wealth, which he gained by the most unremitting toil and industry, there passed away to the majority on the 20th of January last one of the greatest of modern engineers.

"I first made Mr. Whitworth's acquaintance at Birmingham. Birmingham is one of the great manufacturing cities of England, standing on the edge of the ten-yard coal-bed, of what is called the Black Country. The abundance of cheap fuel and the energy of its people early developed it into a workshop of the most various industries, in iron, brass, silver and copper; principally known on this side for its guns, great manufactories of glass, of lacquered ware and electro-plate, of railway-carriages and steam-engines.

"Birmingham stands in the centre of England, geographically; politically, it has a great voice in the affairs of the nation. It is a great liberal centre, represented in Parliament by John Bright and Joseph Chamberlain; but to the engineer it has greater attractions, for here lived Matthew Boulton, who rescued James Watt from the clutches of Roebuck, and whose wealth and influence established the success of the steam engine, and here comes in a link which unites Pennsylvania to these old times. The Lunar Society, founded by Watt, had three other members; Dr. Darwin, whose name will never be forgotten, the genial progenitor of the greatest philosopher of our day, Matthew Boulton and Dr. Priestley, who discovered oxygen, who studied electricity in the light of Franklin's discoveries, and who, when driven out of Birmingham by a rough mob, came over to the great State we live in and found a home and friends.

"With these advantages and this precedent, it only seemed to follow in the natural order of things that some sixty years afterwards George Stephenson and a few kindred spirits should come to Birmingham to found an Institution of Mechanical Engineers.

"Our first presidents were the Stephensons, father and son.

"Our next president, William Fairbairn, was one of the most distinguished engineers of his day. He may be very properly called the 'Father of Experimental Mechanics.' He was not much of a speaker, but he was an authority on almost every mechanical subject; on the strength and form of girders, steam-boilers, and tubes, on iron ships, on riveted joints, on the strength of cast and wrought iron; he was famous for his mill work, he gave us the first riveting-machine, and his most famous design, the bridge over the Menai Straits, had been recently completed when he became our president.

"Joseph Whitworth, who succeeded him, was one of a group of mechanical men who had done great work in their day: James Nasmyth, who invented and perfected the steam hammer; James Kennedy, who made the first inside cylinder-engine with its crank-shaft; Robert Napier, who made the first Cunard steamships, and John Penn, a great marine-engine builder. All these men, except Mr. Nasmyth, became our presidents, and Mr. Whitworth, though physically the weakest in health, survived them all, except Mr. Nasmyth, who still lives in Kent at a good old age.

"Joseph Whitworth was trained in a cotton spinning-machine shop in Manchester, and when he had finished his apprenticeship he went to London to get a better knowledge of his business than he could get in Lancashire. Those who have studied the life of Watt will remember that he did the same thing. So, in later years, Mr.

Nasmyth tells us in his delightful autobiography, how he went to London to improve himself in the mechanic art, and what he learned at Maudsley's, and what exquisite work was made there. Joseph Whitworth, employed as a workman, soon distinguished himself by his skill, and was for some time employed in Mr. Maudsley's private workshop, where his finest work was done.

"It was as a workingman, fighting his way upward in the world, that he made his greatest invention, how to make a true, plane surface. The reasoning out of the process by which this was effected, 'the superposition of three different planes and the cutting away of the higher points by a scraper, as compared with the old plan of filing and grinding, brought about a revolution in the workshops of the world,' was most astonishing as the work of an uneducated man, for what the ancient mathematicians supposed and dreamt about, 'a perfect plane' this man accomplished while toiling at his bench in Maudsley's workshop.

"Mr. Whitworth, after leaving Maudsley's, was employed at Holtzapfel & Clements's Works, and it was in the latter that he was employed on Babbage's famous calculating-machine.

"Having perfected himself as a workman, he now started in Manchester as a tool-maker, and very soon made his name known as one who only did the very best work. No one could have started at a more opportune time. Railways and steamboats were developing all over the world, and good tools could hardly be made quick enough, and he very soon realized a large fortune. It would be impossible for me to tell all that he did in the way of his improvements in tools, and I hasten on to his improvements in screw-threads.

"Mr. Whitworth was early impressed with the idea, that if it were possible for all engineers to use the same sized taps and dies, not only a very great saving would be effected, but all work would be much better done. He therefore made a collection of all the screw-threads of the different firms in England, and from these laid down a system which was a compromise of them all, was at once adopted by the railways, and very soon became as universal as if ordered by an act of Parliament. Only those who remember the chaos which existed before Whitworth's system came into use can have any idea of the confusion and waste of time and money which existed when everybody had their own thread and pitch, and declared that 'theirs was the best in the world.'

"Mr. Whitworth's next great work was in establishing a system of fine measurement. To the great exhibition of 1851 he sent a measuring-machine, capable of measuring to the one-millionth part of an inch, and some years afterwards, in a paper read at the Institution of Mechanical Engineers, advocated the adoption of the inch as the standard of measure for all mechanical engineering work, and that, instead of dividing it into eighths, it should be divided into tenths, etc. I may here briefly state that I was the first to adopt this system. I did my fine measurements with a machine after my own style. I proved that the system he sought to establish was a practicable one, and my adoption of it, as an independent worker, perhaps brought it quicker into general use.

"Mr. Whitworth had now accomplished the following great improvements in mechanical science:

"(1) His plane surface.

"(2) His system of uniform screw-threads.

"(3) His system of fine measurement.

"Mr. Whitworth was now called by the War Department to undertake a series of experiments on the best form of rifle, to be used in the army. These experiments, which were the most valuable and exhaustive of their kind, lead him to adopt a rifle with a very small six-sided bore, the corners of which were rounded, a very quick twist of rifling and a steel barrel. With this rifle he obtained the lowest trajectory, and the greatest penetration with the smallest quantity of powder consumed, and he presented it to the government, charging nothing for his labor. The government did not, for various reasons, accept his rifle, and he then proceeded to apply the same principles to artillery.

"Again he was able to prove that the principles he had applied to the manufacture of rifles was a right one for artillery, but the government would not accept his artillery and he would allow no alteration in his designs, and the guns of Sir William Armstrong were adopted.

"It was during his experiments on rifles that he was led to manufacture steel. He very soon found that iron could not be depended upon for his barrels, and he found so much variation in steel from the makers that he determined to investigate it, and built a small steel-works where he could carefully test, under his own eye, the steel best suited for his work. He adopted a mode of testing his samples which was all his own. His samples were cylinders, some four inches long, bored and turned to gauge, a measured quantity of powder was placed within them, the ends were secured in an hydraulic press, and the powder discharged by electricity, and this proces was continued till the sample burst.

"His experiments on steel led him to adopt a system of casting steel under compression, which he patented, and to the improvement of which he devoted the last years of his life, and from which he expected the greatest results. So satisfied was he of the value of his invention that, when approaching his eightieth year, he determined to build large new steel-works outside the city of Manchester, using for that purpose a large sum of money he had obtained from the sale of his old works in Manchester, which, being in the centre of the city, had become very valuable.

"At the last great exhibition in Paris there were some samples of steel forgings, the like of which had never before been seen. They consisted of a heavy intermediate shaft for a screw propeller, and two liners for the steam cylinders of a steamship. The shaft was east hollow and was partly turned to show how beautifully true it had been forged, and there appeared to be literally nothing required to be turned from it. So it was with the liners; these were not from the great forges of Yorkshire, or from the great steel-works of Krupp; they were the work of an old infirm man close on to eighty years of age, who knew nothing about forging till over sixty, but who, when young, commenced by making everything he did as nearly perfect as it was possible, and who leaves, as his monument the most perfect, the most novel forgings ever produced.

"Mr. Whitworth deeply felt the want of a good education, and many years ago gave the sum of £100,000 to provide a fund for the mechanical training of likely young men. For this he received from the government a baronetcy, but he left no sons to succeed him in his title. He died as he lived, working and toiling to the last. My acquaintance with him goes back for some thirty years, when I served with him as a member of the Council of the Institution of Mechanical Engineers at Birmingham, and was continued up to some five years ago, until my coming to this country. I esteemed him highly and think he was the greatest mechanic of our days."

COMMUNICATIONS

THAWING FROZEN PIPES.

BOSTON, MASS.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—Will you please, if time and space will allow, answer the following:

What is the safest and quickest thing to put in iron pipes, to thaw them out when frozen? also for copper and lead goose-necks? Will salt injure lead or copper? An answer would oblige,

Yours truly, C. ANDREW.

[SALT is probably the best thing. It will not injure either lead or copper.—EDS. AMERICAN ARCHITECT.]

TO DEAFEN A WOODEN FLOOR.

BUFFALO, N. Y., March 7, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—Will you be kind enough to inform me, through the columns of your paper, what is the most efficient method of deafening a floor supported by wooden joists? The spans will be about nineteen feet, and expense is not to be considered so much as getting a floor that will be perfectly sound-proof.

Yours truly, H. C. B.

[MAKE the floor with two sets of beams, one to carry the floor, and the other, which must be absolutely independent of the first, to carry the ceiling. The ceiling-beams may, to save height, run between the floor-beams, provided they do not touch anywhere, so as to carry vibrations from one set to the other. Then deafen the upper set with an inch of mortar, laid either on boards cut-in between the beams, in the so-called New York way, and resting on fillets, or on top of the under flooring, in the Boston way; and the floor will be as sound-proof as it can be made by ordinary means.—EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

THE ART OF HARDENING COPPER.—"Among the ancients who had, of course, no knowledge of steel, its place in the manufacture of edged and other tools and implements requiring hardness and toughness was filled by copper, in the art of hardening which they were very expert," said a gentleman to a reporter to-day. "Copper chisels, axes and other similar tools were used in the building of Solomon's Temple, and in fact, copper held in that day about the same place that steel does today. The earlier inhabitants of our own continent were also experts in this line of manufacture, as evidenced by the numerous tools of copper discovered in the ruins of ancient cities. It is said also that some of the American Indians possessed the secret of hardening copper, but it has long been counted as among the lost arts. While on a trip to Ohio, a few days ago, I became acquainted with a gentleman from New Jersey, J. H. Walker, by name, who informed me that he had discovered a chemical process by which copper can be hardened, the result being mainly accidental, but crowning with success a series of experiments carried on during many years, having that object in view. A hardness almost, but not quite equal to that of steel, can be obtained at comparatively slight expense, and the discovery is likely to be of very great importance in the mechanic arts, as it will cause the employment of copper for many uses for which it is not now deemed fit. The hardened metal will stand a much longer exposure in an electric bath than the unhardened, and in that way tends to cheapen various processes. It is believed it will also prove to be a desirable substitute for the metal now used for bearings in journal-boxes, and Mr. Walker will shortly visit Mr. Pullman, at Chicago, to have a series of experiments instituted which will demonstrate this. He proposes to fit up one or more cars with hardened copper bearings on one side and the ordinary metal bearings on the other, so as to test the durability of the copper as compared with the other, and is confident it will prove preferable. A wealthy gentleman of New York has offered to furnish Mr.

with all the capital necessary to establish a manufactory of ed copper on a commercial scale, agreeing to accept half the of the business for five years, and turn the plant over unencum- to his partner at the end of that time. The discovery will be of interest here in Pittsburgh, where we have a large copper manufacturing industry." — *Pittsburgh Chronicle.*

A Legend of Aix-la-Chapelle. — All over the north of Europe the greatest aversion is felt to be the first to enter a new building or go over a newly-built bridge. If to do this is not thought everywhere and in all cases to entail death, it is considered supremely unlucky. Several German legends are connected with this superstition. The reader, if he has been to Aix-la-Chapelle, has doubtless had the rift in the great door pointed out to him, and has been told how it came there. The devil and the architect made a compact that the first should supply the plans and the second gain the *kudos;* and the devil's pay was to be the first who crossed the threshhold when the building was built. When the building was nearly complete the architect's conscience smote him, and he confessed the compact to the bishop. "We'll do him," said the prelate; that is to say, he said something to this effect in terms more appropriate to the century in which he lived, and to his high ecclesiastical office. When the procession formed to enter the minster for the consecration the devil lurked in ambush behind a pillar, and fixed his wicked eye on a fine fat and succulent little chorister as his destined prey. But alas for his hopes! this fat little boy had been given his instructions, and, as he neared the great door, loosed the chain of a wolf and sent it through. The evil one uttered a howl of rage, snatched up the wolf, and rushed away, giving the door a kick as he passed it that split the solid oak.— *The Cornhill Magazine.*

Ingenuity in Proving the Soundness of an Eye. — In a large factory in which was employed several hundred persons, one of the workmen, in wielding his hammer, carelessly allowed it to slip from his hand. It flew half-way across the room, and struck a fellow-workman in the left eye. The man averred that his eye was blinded by the blow, although a careful examination failed to reveal an injury, there being not a scratch visible. He brought a suit in the courts for compensation for the loss of half of his eyesight, and refused all offers of compromise. Under the law the owner of the factory was responsible for an injury resulting from an accident of this kind, and although he believed that the man was shamming, and that the whole case was an attempt at swindling, he had about made up his mind that he would be compelled to pay the claim. The day of the trial arrived, and in open court an eminent oculist retained by the defence examined the alleged injured member, and gave his opinion that it was as good as the right eye. Upon the plaintiff's loud protest of his inability to see with his left eye, the oculist proved him a perjurer, and satisfied the court and jury of the falsity of his claim. And how do you suppose he did it? Why, simply by knowing that the colors green and red combined make black. He prepared a black card on which a few words were written with green ink. Then the plaintiff was ordered to put on a pair of spectacles with two different glasses, the one for the right eye being red and the one for the left eye consisting of ordinary glass. Then the card was handed him and he was ordered to read the writing on it. This he did without hesitation, and the cheat was at once exposed. The sound right eye, fitted with the red glass, was unable to distinguish the green writing on the black surface of the card, while the left eye, which he pretended was sightless, was the one with which the reading had to be done.— *Pottery Gazette.*

The Cause of the Disaster at Craræ Quarry. — A blue-book has been published containing the report of Colonel A. Ford, her Majesty's inspector of explosives, on the circumstances attending the explosion at Craræ Quarry, Loch Fyne, on September 25, last year. It will be remembered that a large party went on a steamer to see the effect of some blasting operations in the quarry, and that after the explosion they visited the spot. Many of them were seized with faintness, six were dead when rescued, one died afterwards, and five were conveyed to the infirmary at Greenock, where they recovered. Colonel Ford gives, in minute detail, the gases which must have escaped after the explosion of 13,000 pounds of gunpowder, and describes the symptoms which were developed in the injured persons. Probably, Colonel Ford says, the mischief was done by the carbonic oxide — of which 468 pounds were generated by the explosion, an amount which, at the ordinary temperature and pressure, would occupy a space of 6333 cubic feet. This would be sufficient to vitiate one hundred times as many cubic feet of air, but in the presence of carbonic anhydride — of which 3575 pounds were generated — it would render 1,266,600 cubic feet fatal to human life. A very small proportion of that gas in the presence of carbonic anhydride renders the air fatal. Symptoms, however, agree with those attributed to poisoning by carbonic anhydride, and the blood of one of the deceased was so liquid after death that it flowed through the coffin. It is to be regretted, Colonel Ford says, that no opportunity of examining the blood of any of the deceased was afforded, as this would have furnished clear evidence as to which of the poisonous gases which flowed out from the interspaces of the quarry and gradually vitiated the air actually caused the deaths. Colonel Ford expressly relieves any one from blame for the fatal result. — *Exchange.*

A Persian Party-wall Quarrel. — Mr. S. G. W. Benjamin, late United States Minister to Persia, tells the following tale of a party-wall squabble which seems to indicate that petty human natures are the same the world over: —

The missionaries had built a chapel in their own grounds, but adjoining the estate of the Emir Sultaneh, a powerful courtier, who had been endeavoring to persuade them to sell the mission premises to him. As no price could be agreed upon they declined to sell, and he then entered on a series of annoyances intended to force them to sell at any price. Twice he raised a mob of his own servants, aided by some of the canaille, who, by violence, drove the men working on the chapel from the premises. By employing great urgency at the Foreign Office I succeeded in preventing a recurrence of such outrages. By the expressed wish of the Shah a conference was then held at the Foreign Office to agree upon a *modus vivendi.*

The plan I suggested proved entirely acceptable to the Shah and the Minister of Foreign Affairs, and the Emir Sultaneh was instructed to accept it. While apparently doing so he yet raised difficulties, doubtless in part because a powerful faction, opposed to the missionaries, was behind him, and eventually he resorted again to his tactics of annoyance. One of these was the erection of a screen-wall on a party-wall between the two premises. In this addition he caused two windows to be opened, overlooking the grounds of our citizens. This was such a direct violation of the Persian law that, although not contrary to American customs, it could, under no circumstances, be accepted except as a gross insult, intended as an act of persecution. To allow it to pass unnoticed would be to invite further attacks on our rights. With some difficulty I succeeded in having the windows walled up. A few months later, during my temporary absence in the suburbs, the Emir Sultaneh hastily threw up a pavilion on a corner of the party-wall, and opened five new windows directly overlooking the girls' school of the American mission. The matter had now reached a crisis; the Minister of Foreign Affairs was either in league with or afraid of the power of the Emir Sultaneh, who seemed determined to invade the right to the quiet enjoyment of property awarded by the treaty. In this emergency I succeeded by finesse in obtaining a legal decision from Hadgi Mollah Alee, the head of the Mussulmans of Persia, and also Chief Justice and expounder of the law, which officially and emphatically announced the law on the subject, in language so strong that the aggrieved party was even given authority to shoot any one opening windows overlooking a neighbor's grounds without permission. Armed with this document, which represented the highest authority in the realm, I succeeded at last in bringing the Government to terms, and the offending windows were finally closed with masonry. The effect was at once seen in the quick redress given us soon after in an affair of far more importance at Selmas.

TRADE SURVEYS

The halt in the upward tendency in prices has strengthened the confidence of builders and projectors of all kinds. It is evident enough that there will be no general advance in material and merchandise. Conservative feelings prevail and enterprise is anxious that nothing shall occur to arrest the swelling volume of business. Prices may advance in particular lines, and may, and probably will decline in other lines, but the general level will be maintained throughout the year. These statements are not based on surface indications but upon facts and tendencies which are familiar to the careful students of current trade and industrial progress.

There is good reason for the wide-spread confidence in expanding trade. The reports from architects and real-estate interests in cities from Boston to Chicago and Kansas City exhibit a general improvement in real estate, in the granting of permits, in the number of inquiries and wants, and in the projection of large railroad, house, and shop building-operations. Increased building activity will take place in all the larger cities and in the manufacturing towns of the New England and Middle States. In New York 560 buildings were projected in January and February, involving nearly $9,0000,000. In Philadelphia, Pittsburgh, Chicago, Cincinnati, and in some large cities west of the Mississippi River banking and individual capital is being diverted from mere loaning purposes into actual constructive work. Iron and steel making are absorbing their full share, and so are a multitude of smaller industries which are evincing wonderful expanding capabilities. Taking a comprehensive view, it can be with safety asserted that the volume of capital that can be found in a score or two of leading industries will be double that of 1885. This wonderful growth is particularly observable all through New York, Pennsylvania, Ohio and Alabama, and in other States though less pronounced. Factories and shops of all kinds, foundries for casting everything from heavy mill castings down to stoves. Engine-works are making engines from 5 to 500 horse-power, and a number of industrial establishments, big and little, are springing up or expanding existing proportions at a rate which is surprising even to the American public familiar with rapid development. Within a week over 100,000 tons of railway material have been sent to points of delivery, and new orders aggregating 30,000 tons of rails, 60 locomotives and 3,000 and over freight-cars have been placed. The Eastern rail-mills control the bulk of the rail trade, but the Western car-works are better able to control the car-making industry. The lumber trade will have an excellent season. Demand will be heavy at all points. Navigation will probably open early. Heavy deliveries are being made especially to far Western points. In the East large shipments will be delayed, as usual, until the lakes open. Western receipts this year have been much larger than last in view of the heavier demand.

The commercial features are, in the main, favorable to the consumer. Stocks are large in all leading staple products. Money is abundant and is seeking opportunities in the West and South. Railroad-building has doubled last year's figures while traffic and earnings show encouraging expansion. The impulse given last autumn is still active, and mercantile and manufacturing and railroad interests are all crowding ahead, each anxious to lead in the work of preparation for greater activity. Building-material, iron, steel, cotton, wool, petroleum, motive-power, all will remain at about former cost, while demand will keep every wheel busy and maintain confidence by an accumulation of orders beyond prompt execution. Details by the hundred could be enumerated to lead to these conclusions. The manufacturing world was never busier than at present. The railroad-builders have over 25,000 miles of road projected. The ore-miners will be able to increase output 50 per cent after this year's expansion of capacity is brought about. The coal-producers will be able, after this year, to arrange an output of 3,000,000 tons of coal per week, and the rail-makers to turn out rails enough to lay 80 miles of road per day. This enormous expansion points necessarily to a decline in prices which, when it comes, will cause no disaster, as the cost of living will, through causes now at work, decline in like proportion. The new traffic regulations have been anticipated and will assist in the progress of the work of equalizing the products of labor between all who contribute to its production.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, by TICKNOR & COMPANY, Boston, Mass. No. 586.

MARCH 19, 1887.

Entered at the Post-Office at Boston as second-class matter.

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A DREADFUL accident took place this week near Boston, on a branch of the Boston and Providence Railroad, where six crowded passenger-cars, out of a train of nine, broke through a bridge over a highway, and fell about twenty-five feet, one above another, crushing the woodwork into splinters, and killing nearly forty people, besides injuring about one hundred more. The bridge was of iron, about one hundred and twenty-five feet in span, supported by two trusses. According to the newspaper accounts, the trusses were originally of wood, but about thirty years ago one of the wooden ones was removed, and an iron one set in its place. Twenty years later the other wooden truss was also replaced by an iron one, but of a different design from the iron one previously used, so that the bridge rested on two iron trusses of the same span, but of different design and construction, and differing about twenty years in age. The roadway was designed for a double track, but only one track had been laid over it, and this was placed at the side, so as to allow room for the second track beside it. The cause of the accident is as yet unknown. A serious flaw was found in one of the broken members of the truss, near the abutment, but there are indications that the first fracture occurred near the middle of the span; and a thorough analysis of the design of each truss will probably be necessary, to give the clue for finding the weak or corroded member whose failure brought about the destruction of the bridge. Of course, innumerable theories are offered, to explain the disaster, by those ingenious individuals who furnish science to newspaper representatives. One of these persons, who was discovered in the offices of the railway company, is reported to have said that the bridge was an excellent one, in good condition, and regularly inspected, and he could only account for its destruction by supposing that a truck or some other portion of a car had given way just before the train reached the crossing, and the broken piece, hanging below the car, had caught in the bridge and knocked it endwise off the abutment. This novel idea is particularly to be commended to engineers, who will henceforth, we trust, see to it that their railway bridges are anchored to the neighboring trees, or some other convenient objects, so that they may not be in danger of sticking to the car-wheels and getting carried off. Another expert in metallurgy accounted for the trouble in a different way. He had observed, it is said, that there had been a good deal of cold weather during the past winter, and, in his opinion, although the day of the accident was a warm one, the previous cold had contracted the metal of the trusses so much as to make it brittle and thus destroy its strength. The superintendent of the railway constructions, under whose care the bridge was built, could give no further information to the reporters than that the trusses were made of "good, substantial material," a delicate compliment to wrought-iron, which, if not new, is no doubt well-deserved; and that the "stringers and rods" were "firmly bolted." Just how they were bolted, and what was their size and disposition, and whether the "substantial material" of the trusses was judiciously distributed, he did not undertake to say, and these points, which, to the professional mind, contain the explanation of the whole matter, must probably be left for judicial inquiry to determine.

MR. WILLIAM H. SAYWARD, the Secretary of the Boston Master-Builders' Association, has made a good many valuable contributions to the subject of the relations of employers and employed, but none, so far as we know, more noteworthy than that with which he is credited in the Boston papers of a recent date. It seems that the granite-cutters of the city and vicinity, who are rather famous for their disposition to strike on small provocation, are now off duty, in consequence of some dispute with the masters. The latter had the good sense to propose to their men that the differences between them should be settled by arbitration, and the men acceded, appointing as their representative Mr. Frank K. Foster, an active Knight of Labor, and recently candidate for Lieutenant-Governor of the State of Massachusetts, while the masters chose as their arbitrator Mr. Sayward. The conference between the two arbitrators went on prosperously enough until a question was raised in regard to the terms which should be agreed upon about the employment of "scab," or non-union labor. This point Mr. Sayward declined to discuss, saying that in his opinion every non-union man was entitled to work wherever he could find employment, and he would not be a party to any infringement of this first principle of human rights. The other arbitrator does not seem to have been willing to waive the matter, and the conference came to an end, much to the disadvantage, as we take it, of the granite-cutters, who will have hard work to agree upon another arbitrator as fair and well-disposed toward them as Mr. Sayward, and still harder work, we hope, in finding any man, not enslaved by the oaths of the labor associations, who will consent to be a party to an agreement, or rather, a conspiracy, for excluding all persons not belonging to a certain society from employment in one of the most important industries in the free city of Boston. It is quite time that society should assert itself in defence of the "scabs," or, in other words, the brave and independent citizens who will submit to no man's dictation as to the amount of work they shall do for the sake of their wives and children, or the wages they shall accept, or the disposition they shall make of their income; and who can now act upon their principles only at the risk of public vituperation, proscription, bruises, mutilation, and even death, and public opinion could hardly have a better counsellor in devising means for preventing the oppression of one set of poor working people by another set than Mr. Sayward.

THE Mayor of New York has appointed Mr. James C. Bayles, the well-known editor of the *Iron Age* and the *Metal-Worker*, to be President of the Board of Health of the city, in place of General Shaler. We are happy to congratulate the citizens of New York upon so admirable a selection. Mr. Bayles has a high reputation as a sanitarian all over the country. His first book on sanitary subjects, the well-known "*House Drainage and Water Supply*," has passed through several editions, and is still, perhaps, the best and most complete work, for the general reader, that has yet been published; while his active and intelligent efforts to enlighten the residents of the suburban town of Orange, where he has a country house, upon matters of sanitation, and to promote improvements in the drainage and public hygiene of the place, have kept him very prominently before the eyes of those interested in such subjects. As the administrator of a very responsible office, Mr. Bayles is likely to show an energy proportionate to his knowledge of the matters to which his duties relate. His successful management of the journals under his charge, as well as of his private affairs, indicates his capacity for business, while the independence and ability of his writing show him to be possessed of opinions which he will not be diffident about carrying into action.

FROM the office of the *Nation* has been kindly forwarded to us a slip cut from the Paris *Temps*, describing an apparatus intended to record the topography of roads by an automatic apparatus, which is set in operation by the movement over the

road to be examined of a small carriage containing the apparatus, and is controlled in such a way by the movements of the car as to register all varieties of level and changes in direction. The mechanism employed is quite simple. The wheels of the carriage set in motion drums, on which are wound strips of paper, and on these strips the record is made. The changes of direction of the movement of the carriage in a horizontal plane are shown by the change of position of the axis of the carriage with regard to a horizontal plate, which is, probably by means of a powerful magnetic needle, kept in a position fixed in respect to the earth's axis; a pencil, attached to the carriage so as to partake of its motion, describing on the paper spread on the magnetic plate below it an arc corresponding to the number of degrees of variation between the direction of each new movement and that which preceded it. Vertical changes of direction, or ascents and descents, are shown in a similar manner by the marks on a roll of paper wound on a drum of a pencil attached to the arm of a double float, which preserves an invariable level. The whole affair, which is called an "autographometer" is the invention of an engineer, recently engaged at Panama in topographical surveys, and seems to resemble the apparatus used in this country on railroads, for recording the characteristics of the line over which the car containing it is hauled.

THE French technical journals seem to be quite delighted with the report of the Superintendent of foreign mail service in the New York Post-Office, who, after keeping a record of the length of time occupied by the various Atlantic mail steamers in reaching their destination from New York, ascertained that the three new steamers of the Compagnie Générale Transatlantique, the *Bretagne*, *Champagne*, and *Bourgogne*, had all surpassed in average speed any other ships on the Atlantic. A new regulation of the Post-Office Department provides that the rate of speed of steamers whose owners would like to carry the mails shall be ascertained in this way, and the contract for transportation awarded to the fastest ship leaving port on any given date; and in accordance with this rule the French steamers have of late usually taken the mails for the Continent, while on one occasion, a few weeks ago, the mails for England were sent from New York on the *Champagne*, by the way of Havre. This is said to have been the first time that mails were ever sent from America to England by the way of France, and as the three new ships were all built at St. Nazaire, patriotic Frenchmen have some reason to be proud of the success of their countrymen in disputing with England the superiority which the latter country has, until lately, maintained in such matters. The prowess of the Breton builders appears to have stimulated the whole shipbuilding interest in France, and one of the fruits of the sudden impulse is to be seen in the opening of an international maritime exhibition at Havre. The buildings for the exhibition are, by a happy inspiration, placed around a huge dock, in which are to be collected examples of interesting naval constructions; the Government, which is one of the principal exhibitors, sending a corvette in complete order, with arrangements for exhibiting on board the details of modern naval hygiene; while marine engines, models of vessels, steering, hoisting and propelling apparatus, ship-builders' tools, and the small accessories of maritime life will occupy the buildings. With a fancy that is rather more ingenious than artistic, the main entrance to the exhibition is marked by a dome, forty or fifty feet in diameter, which is made to represent a globe, engaged, as far as the Tropic of Capricorn, in the adjoining roofs, but showing most of the civilized world on the exposed portion of its surface, and carrying a fine collection of flags on its elongated North Pole. Of late years the commerce of French ports has diminished greatly, that which once kept Havre busy having gone to Antwerp, while much of the Mediterranean trade has forsaken Marseilles and gone to Genoa; so that the interests of the seaport towns need, almost as much as they do with us, the encouragement which such an exhibition will give; and we do not doubt that its results will be such as to gratify its public-spirited promoters.

A NOVELTY in competitions is in progress in England, where the Government of the new Imperial Institute has undertaken to call the services of architects to its aid. The Institute, which is a very dignified corporation, proposes to erect, on a site some six and one-half acres in extent, an immense building, to contain exhibition galleries, conference rooms, emigration offices, and so on; and invites architects willing to compete for the work to send to the Secretary their names, together with a list of the important public buildings which they have designed. Out of the applicants six will be selected, under professional advice, who will be furnished with instructions, and allowed three months to prepare their designs; and one thousand dollars will be paid to each competitor for his trouble, provided his design is found to be in accordance with the instructions. A competent committee, to which the competitors may, if they choose, add a professional assessor, chosen by themselves, will then select from the designs the one which best meets the requirements of the case, the inference being that the author of this will be employed to carry it out at the usual remuneration.

NOT long ago we quoted some of M. Trélat's striking observations on the effect of light on the occupants of dwelling-houses, and the importance of illuminating rooms by windows carried as near the ceiling as possible, and not obscured by curtains. These suggestions seem to have made a considerable impression in France, and Dr. Hector George, a well-known writer on hygiene, recently delivered a lecture on the same subject at the Paris Conservatoire des Arts et Métiers, in which he spoke with approbation of M. Trélat's paper, and added some curious information from the stores of his own knowledge. As reported in *Le Génie Civil*, Dr. George remarked that light was found to be an indispensable stimulant to vital action. Among plants, the sensitive mimosa, which presents the nearest approach to voluntary motion to be seen in the vegetable kingdom, loses its irritability in darkness. It recovers it again by exposure to light; but if deprived of light for six days, the plant is so far enervated that it cannot be revived, and it dies. With men and animals the red blood-globules are formed only under the influence of light, and disappear by absorption if the subject is kept in darkness. For this reason butchers often keep calves in dark places, to render their meat white, and miners, silk-weavers, and other persons who pass their days in obscurity, become pale, inert and "bloodless," as is the common phrase. With the development of red globules, by the effect of light, strength and spirits return. The red globules perform the function of carrying the oxygen of the air from the lungs to the different parts of the body, and when they are abundant there is a sensation of life and activity, a good digestion, full respiration, and cheerful temper. Besides the influence of light upon the respiration and oxygenation of the blood, it acts powerfully on the skin, exciting its action, tanning or burning it to a brown color, and even causing the inflammatory condition known as sunstroke, which, as Dr. George says, is shown to be produced by light, and not by heat, from the fact that it is caused by the reflection of sunlight by water, which sends back the light, but not the rays of heat.

IN eruptive diseases the action of light on the skin is such as to aggravate the inflammation, and physicians keep their small-pox patients in a dark room, or cover their faces with lamp-black paste, to moderate the eruption, and lessen the scars which it leaves behind it. The influence of light in promoting bodily activity is well understood by farmers who keep in darkness the oxen that they wish to fatten, the cows whose yield of milk they wish to increase, and the setting hens which show too lively a disposition, in order to secure the quiet, sluggish state which promotes the objects they have in view. On certain inferior animals the action of light is sometimes unfavorable, and it has been observed that the microbes of infection and fermentation are destroyed, not only by a free exposure to air, but by light alone, so that sunshine, independent of its influence in setting up currents of air, has a purifying power of its own, the extent of which we do not as yet know. In the care of young children, the effect of light is a matter of great importance. In dark or shaded houses development goes on imperfectly. The tadpole, without sunshine, lives always a tadpole, never showing any disposition to abandon its gills and tail; and the effects of deprivation of light in checking growth in infancy remain visible throughout the life of the individual. Children naturally love the light, and fear darkness. A baby in its cradle always looks toward the window, so that unless its face is turned either directly toward or away from the light it is apt to acquire a permanent deviation of the eyes; and the terrors of children in dark rooms indicate a physical condition which may result in serious injury if the distress of the nerves is not relieved by lighting a candle or lamp.

PICTURES OF THE SEASON IN NEW YORK.—I.



EXHIBITIONS of various sorts and sizes have been numerous this year and, as a rule, have seemed to interest the public. Those which revealed American work have contained few remarkable pictures, but have shown a fair average: and comparatively low-priced works have been generously purchased. The shops have been filled with a succession of the good foreign products of to-day, but at last there seems to be a dearth in the market of the still better foreign products of yesterday. Really representative works by the great French masters of the last generation are not so easily to be secured as a few years ago, even by those whose purses are phenomenally well filled.

The first exhibition of the season, if I remember rightly, was that of the so-called Sharples pictures. It contained a number of portraits of charming young ladies with high-sounding names, said to have been completed by Maclise and other English painters, from sketches made by Sharples in New York and Philadelphia in the earliest years of the century — smooth, gaudy, chromo-looking works, with no artistic, and but questionable historic value; a portrait of a very beautiful woman, also devoid of artistic merit, which was asserted to be the only existing likeness of the mother of Washington; portraits of Robert Fulton and of Dr. Priestley, which were good, though not remarkable works of art; and two portraits of Washington and one of his wife which were extremely good and interesting works of art. These last three were said to have been painted from life by Sharples, and at the time when they were exhibited a bulky volume was published by the gentleman who had brought them from England, giving what purported to be their history accompanied by a mass of documentary evidence to sustain their authenticity and prove their value. As this book was not immediately challenged by professed historians its bold assertions were accepted on faith by too many of those who felt the intrinsic charm of the three Washington pictures. Many voices pronounced them the most satisfactory likeness of their subjects that exist, and urged their purchase for the American people. Fortunate were those who confined the expression of such sentiments to words. Those of us who were rash enough to put them forth in print have since been under the sad necessity of retracting all commendation of the portraits save such as concerned their intrinsic worth as paintings. For their showman, in a what proved to be a very rash moment, appealed to the Massachusetts Historical Society to endorse them: this Society appointed a committee of investigation, with Francis Parkman at its head; and this committee, though strongly prepossessed in favor of the pictures, soon found that the documents upon which their claims were based were a mere tissue of falsehoods, fables, and forgeries. Their elaborate dissection of Major Walter's book was simple enough in its processes and clear enough in its outcome to convince the most ignorant reader of the justice of their verdict. This verdict was that the three chief portraits may have been painted upon some crayon basis furnished by Sharples, but were not painted by him from life; that when or by whom they *were* painted cannot possibly be shown from any evidence in hand; and that the portrait of Mary Washington has no shred of a title to authenticity. No real answer to any charge in the indictment has been published by Major Walter, and it is said that he has now returned to England taking his whole collection with him and leaving naught but his extraordinary book to preserve the memory of one of the most boldfaced, yet stupid attempts that have ever been made to trade upon an appeal to our patriotisms and our love of art. Sometimes it seems unfortunate that, as a nation, we are so slow to respond to such appeals. But in this case our lack of touch-and-go enthusiasm has certainly been lucky. The only pity is that this experience may make us still more cold and distrustful than of yore on possible future occasions, when ready enthusiasm would really be desirable.

Autumn exhibitions of American work were opened in October both at the American Art Gallery and at the Academy. The former contained a few good large pictures by "new men" in Paris, and the latter, at least, one very excellent canvas — Mr. Winslow Homer's "Lost in the Fog." But neither was, as a whole, very interesting, and neither was as rich even in "promising" works as might have been hoped.

The winter exhibition at the Metropolitan Museum, on the contrary, showed many things of native origin that were distinctly fine. Not all of them were new, but all of them were recent, and the impression they made was most consoling if one had been accepting the two down-town exhibitions as true signs and symbols of the current status of American work. In another part of the Museum were shown, at the same time, a number of "Old Masters" which had been brought from Paris and loaned for a brief period by M. Sedelmeyer. The names they bore were of the highest sound. Rembrandt and Ruysdael, for example, were each credited with several large canvases, and Terborg, Hals, Tiépolo, Watteau, Greuze, Van Eyck, Rubens, and Murillo were among the other great men whose products we were bidden to admire. But if we did not admire unreservedly, the fault was not in our eyes. Some of the pictures — as, for instance, a dual portrait by Sir Joshua Reynolds, two heads, by Greuze, a Venetian scene, by Canaletto, and a Terboog seemed to be genuine, though not exceptionally excellent examples. But many other works were, at least, dubious — if authentic were certainly not very good; and others, like the Rembrandts, had little evidence to give in their own behalf. A portrait resembling those of Rembrandt's wife was apparently a good example of the work of one of Rembrandt's best scholars; but of its companions not even so much as this could be said. As a whole, the collection was not a fine one, nor did it contain a single first-class picture. I have seen worse collections of Old Masters in private palaces abroad, and even in small local museums; and there is a much worse one owned by the Metropolitan Museum itself. But it was hardly good enough to be worth the trouble of importation, and could not have been really instructive to untravelled eyes.

The only important picture that has recently been given to the Museum is a canvas 12 x 18 feet in size, and valued at $20,000, painted by Brozig, and presented by Mr. Morris K. Jesup. It represents Columbus at the Court of Spain, and, though a clever enough piece of painting, is academic, uninteresting, and almost without value as a help towards popular education in art.

As Brozig is the son-in-law of M. Sedelmeyer, as this gentleman brought the picture over with Munkácsy's famous "Christ before Pilate," and as he has also sold this and sundry smaller works to a citizen of Philadelphia, he, at least, will not return home with a feeling that America is disinclined to foster the arts. The exhibition of the "Christ before Pilate" has been going on for months. But its success has been a *succès de curiosité* rather than a genuine artistic triumph. All the metaphorical blare of trumpets with which it was heralded, and all the very literal blaze of theatrical arrangements, amid which it has been shown, have not blinded us to the fact that it is not a great picture, or a satisfactory conception of the theme, but simply a very clever, effective piece of brushwork, feeble in idea and in sentiment alike. I think it is one of the most cheering among recent signs of our growth in artistic feeling that such should have been the case. A big book filled with laudatory comments from the press of every European country was industriously circulated by M. Sedelmeyer when the exhibition was opened. But a similar book could never be made up from the notices that have appeared in print on this side of the ocean. And even private conversation has proved a very widespread disappointment with the work. Its pictorial shortcomings — its weakness in composition and in dramatic force — are more generally noted than one might have thought would be the case; and even when these are not distinctly perceived its lack of genuine feeling has been clearly recognized.

Munkácsy himself followed his picture to New York, was something of a "social lion" during his stay, and executed certain portraits which, I hear, are fine examples of his technical skill, and for which he received such enormous prices that we may assuredly look forward to an influx of French artists during the next few years. Indeed this winter we have had others among us. M. Rénouf, well known through his fine "realistic" picture of a child in a boat with her grandfather, called "A Helping Hand" came early in the winter, bringing a few portraits with him, and desiring to paint others here. What success fell to his lot I do not know. But M. Rajon, the famous reproductive etcher, has gone home so well pleased with his stay that he intends to return next year. He did no etching while here, but studied at least one picture — Jules Bréton's "Last Ray" — which he is to etch in Paris under the painter's own eye. And he executed two or three charming portraits in pastel, and made, in Goupil's gallery, a delightful exhibition of his work, which contained many of his finest etchings, as well as a number of very spirited and charming small portraits in black or red crayon. His large etching of a portrait of Darwin, from a painting, I think, by Mr. Ouless, was the great feature of the collection, and as splendid a piece of work as this art, in its reproductive phase, has ever produced.

The Black-and-White Exhibition, under the auspices of the Salmagundi Club, was this year not of much interest. Sketches and studies are chiefly what one wants in work of this sort, and methods which do not compete with oil-painting in colors, but have an individuality and a charm of their own. But a majority of the works exhibited this year were in black-and-white oils, and seem to have been executed with a wish to realize the elaborateness, the depth, the intensity and the completeness of tone more proper to work in color. There was much clever execution to be noted, but a great deal of it was wasted in this vain effort after the unattainable. The collection of architectural drawings, shown at the same time under the auspices of the Architectural League, was infinitely more interesting. It was weak in its showing of contemporary products in brick and stone, but strong in its showing of various styles and draughtmanship. A few of Mr. Stanford White's water-color sketches — extraordinarily delicate, yet virile in execution and marvellously lovely in color — stood out above all their surroundings. But they were almost rivalled by the larger water-colors recently sent home from Europe by Mr. Mead. A number of this young artist's

pencil-drawings were also shown, and I need hardly tell the readers of this journal how extremely good they were—how individual in method, how succinct, yet clear and truth-telling, how brilliant, how thoroughly artistic. But in this exhibition one saw, for the first time, what a great gift for color he also possesses—a gift so great that one can but hope he will devote himself for life to the study and practice of that decorative art, the very name of which has become almost an offence, so constantly is it still practised without study and by those who have no slightest claim to architectural knowledge, and apparently but small respect for the architect's precedent labors.

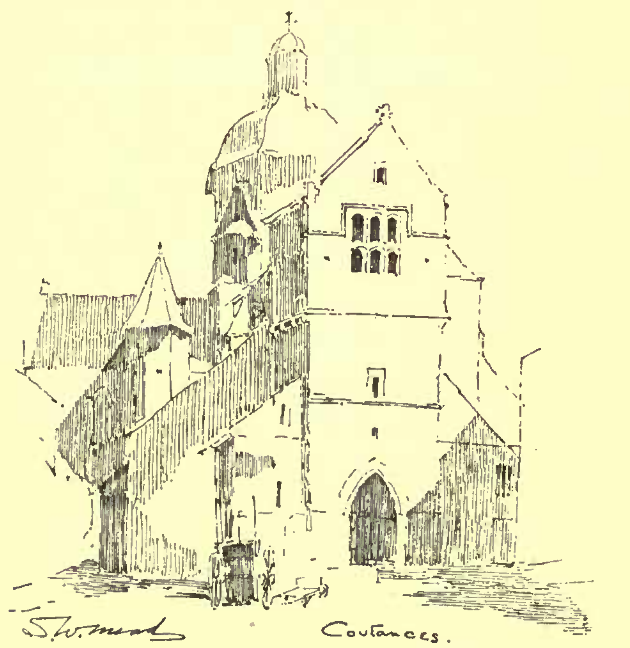
Very different from these water-colors in aim, and consequently in effect, but also extremely good in their own way, were a long series by Mr. Marschal, reproducing the interior decorations of the Palace of Fontainebleau. No transcripts of such a kind could have been more detailed, more precise, more thoroughly explanatory. Yet they were not mere conscientious documents, valuable only for the evidence they gave about the work they reproduced. They had an intrinsic charm as well, being distinctly non-mechanical in handling —showing a freedom and grace of touch that was quite wonderful, considering their smallness of scale and fulness of distinct detail.

I should have noted that in the Black-and-White Exhibition proper were included the originals of Mr. Cox's designs for the "*Blessed Damozel*" and of Mr. Abbey's "*She Stoops to Conquer*"—two of the most-successful Christmas books of this or any season. The former were large monochrome oil-paintings, but the latter were drawings in pen-and-ink, of the most delightful description. They were by far the best feature of the exhibition alike in dramatic, human interest, and in consummate skill of execution.

M. G. VAN RENSSELAER.

PARIS CHURCHES.[1]—IV.

ST. MARTIN DES CHAMPS, ST. MERRI, AND ST. SÉVERIN.



STRICTLY speaking, St. Martin des Champs is no longer a church; but as the remains of the ancient priory are important, and the buildings in the best style of the thirteenth century, they are well worth studying. St. Martin des Champs is the only conventual building of Paris, which retains its original physiognomy; and although it is perverted into a museum, it still contains within its precincts, a walled-in entrance-court with one of the original corner turrets, part of the cloisters, the refectory and the church. Formerly hidden away in the narrow rue St. Martin, it has gained in pictorial importance since the piercing of the new Boulevard Sebastopol.

Although the priory ranked after all the abbeys of Paris, it was well-nigh as important, and as rich. The prior enjoyed a revenue of 45,000 *livres*, and had the right of nomination to sixty beneficies, twenty-nine priories, and many curacies and chapels.

Tradition records that the monastery was built upon the site of one of St. Martin's acts of charity: healing the leper. Born in the reign of Constantine the Great, at what is now Stain, in Hungary, Martin early became a Christian, but his parents being Pagans, he was not baptized until comparatively late in life. His father was a Roman soldier and tribune, and the son was enrolled in a cavalry legion. Obliged to leave his native country for Gaul, we find him in the year 332 quartered at Amiens; and here it was that he performed the act which has made him so famous in literature and art—the cutting of his cloak in two, to clothe a starving beggar. Martin Schoen gives him such a voluminous mantle that one feels the act of cutting it in halves to have been that of a highly-practical mind—enough for you and enough for me. But other painters, on the contrary, depict the cloak as of such very small dimensions, that one only wonders the saint did not give it all to the beggar, for half of the garment could scarcely have benefited either party. This act brought him commendation from Heaven, and he hastened to receive baptism, being then twenty-three years of age. At forty he left the army, and was elected Bishop of Tours; and again we read of a similar story of clothing the naked, this time with his sacerdotal vestment during the celebration of mass.

St. Martin founded many churches and monasteries, and many more were dedicated to him after his death: Marmoutier, near Nantes, was a very celebrated convent, and in England there are a great many churches of which he is the patron. When St. Augustine went to Britain, he found a chapel in the neighborhood of Canterbury, which had been dedicated to St. Martin in the fifth century, and there he baptized his first converts. The church is certainly one of the earliest in England, and the font cannot be later than the eleventh century; but whether it is the identical one in which King Ethelbert was baptized in the seventh century, is doubtful. Still, though much restored from time to time, the church retains numbers of Roman bricks incorporated into its walls. That Queen Bertha worshipped in a church on the same spot is certain, and tradition points to the stone coffin in which she lies.

To return to St. Martin, the legend relates that when he was entering Paris as Bishop of Tours, he met a wretched leper at the gate, and filled with compassion and love, he embraced him, and thus healed him of his leprosy. To commemorate such deeds, two churches were not too many; but it was not until 1060 that the monastery was founded under Henri I. Phillippe I dedicated the church in 1067, and placed the new foundation under the patronage of the Abbey of Cluny. It was originally situated as it name implies, amongst fields; and its domains consisting of several acres of land which became more and more valuable as time went on, it was naturally enormously rich. Amongst its long list of priors, are many illustrious names; at first regular and latterly titular, of which latter class the Cardinal de Richelieu was one.

The only demolition that is much to be regretted is the Chapel of St. Michel, which Nicolas Arrade founded in the thirteenth century. Intended as a family vault, it contained, a hundred years ago, more than thirty tombs of his descendants. These have been destroyed since the departure of the monks; but to them we owe the destruction of the chapter-house, the tower, the lady chapel, and several royal statues; and the rebuilding of the cloister, which is now "ornamented" with Doric columns was their work. This vandalism was perpetrated rather more than a century and a half ago.

The church belongs to two distinct periods. The nave was built about the middle of the thirteenth century, and is without aisles or pillars. It is lighted by pointed windows, and covered by a pointed timber roof. The choir and apse belong to the middle of the twelfth century, and are peculiar in their arrangement. The apse is raised from the nave, and round it on a lower level are double aisles, divided by clustered columns which support the vaulting. Thus, the apse is approached from the nave by steps in the usual manner; but to enter the aisles of the former, one has to descend three or four steps from the nave. The whole has been decorated with color, and if restored to its proper use, would be, after the Ste. Chapelle, the most interesting church in Paris. As it is, its desecration shocks the feelings of all but the materialists, and the noise of the machinery in motion is distracting to the nerves of the student. Surely a better and more appropriate building might be found in which to place hydraulic machines, ploughs and shafts worked by steam-power.

The refectory is one of the *chefs-d'œuvre* of the thirteenth century, and quite worthy of Pierre de Montereau, to whom tradition assigns it. It is divided into eight bays in its length, the vault springing from seven central pillars. These tall elegant shafts divide the buildings into two naves of equal width. The windows on one side are blocked up; on the other, they consist of two lights with a rose above. Mr. Fergusson, in his "*Hand-book of Architecture*," gives a sketch of one of these windows, page 697, Figure 564 (Ed. 1855). The carving of the capitals and bosses is exquisite. On one side is a reading-pulpit built into the wall. This is approached by a stone staircase in the wall, which is pierced by a narrow, lancet-shaped open arcade to give light. The pulpit is lighted from without by three windows. The refectory suffers less than the chapel from its change of hands, being used as the library of the museum. On the south wall is a painting in fresco by M. Steinheil of St. Martin dividing his cloak, which harmonizes very well with the coloring of the rest of the building. All the other parts of the museum are modern.

ST. MERRI.

At the bottom of the Rue St. Martin is a spot which, during the ages of faith, was much reverenced for its miracle-working powers. In the seventh century, the whole district was a forest, and doubtless the king and courtiers hunted there; for when first the Louvre was built, it was a mere hunting-box. Paris consisted only of the present Cité—the island on which stands Notre Dame—and beyond, the country was no doubt infested with wild animals, as well as game. In the midst of the wood stood a little chapel dedicated to St. Peter, which was as much surrounded by trees and shrubs as the present church of St. Merri is by streets and houses. Adjoining this church was a cell, or hermitage, and it was there that St. Merri, and his disciple, St. Frodulphe, sojourned when on their way from Autun to the

[1] Continued from page 253, No. 570.

shrines of St. Deny's and St. Germain. St. Merri was abbot of Autun, but he seems to have been glad of a change to the great city; for so it befell, that instead of returning to his abbey, he stayed in this little wooded retreat, undisturbed by aught but the singing of birds and the sighs of the trees, for the space of three years. Then, on the 29th of August, about the year 700, he died, and was buried in the chapel. Many and wondrous were the miracles wrought at his tomb; and so famous did it become, that St. Peter's patronage was forgotten, and the church was looked upon by the people as being under the exclusive protection of St. Merri.

About the end of the ninth century, Eudes de Fauconnier desired to celebrate his part in the expulsion of the Normans from the neighborhood, by erecting a new church on the site of the little chapel, or in its immediate neighborhood. This was dedicated to the two saints, St. Merri being placed first. When this church, in its turn, was demolished in the time of François I, the remains of the founder were found in a stone coffin, still shod in his leathern boots. In the twelfth century the church became a parish one, and in the next century it was made collegiate. A strange custom prevailed in the Middle Ages, of affiliating one church upon another. Thus, St. Germain des Près was called the "third daughter" of the Abbey of Cluny; and in the same way, St. Merri was the third daughter of Notre Dame, whose canons were connected with the daughter church. The chapter of St. Merri consisted of a *chefceir* who filled the place of the *curé*, six canons and six chaplains.

The existing church was built 1520–1642. The exterior is the best part. Covered with ornament in the Flamboyant style, the west front, with its three portals, is a good example of rich ornamentation of the usual kind. The statues in the niches were placed in 1842, replacing those destroyed in the Revolution. Those round the *voussure* are copied from one of the portals of Notre Dame, and consequently are two centuries too early for the church. Another blunder of the modern architect is the placing of a demon in the centre at the point of the arch, where the mediæval artists invariably put the figure of Christ or of Our Lady. The woodwork of the great door has not been renovated, and is quite worth studying for its fine carving. The lower part of the tower is contemporary with the church, but the upper stories have been rebuilt in the seventeenth century, and consist of Renaissance arches and shafts. Much of the tracery of the windows has been destroyed, but the pinnacles and gargoyles remain. Built on a cruciform plan, it has two other doors, but the presbytery hides all but the crowning pinnacle of one. In fact, like many Continental churches, it is so built about by surrounding houses that one only gets a view of it here and there. It is extraordinary that in such a city as Paris this is tolerated. I think it is at St. Germain l'Auxerrois that a wooden hut is built in between the buttresses of the east end, completely filling up two windows of the apse. The whole erection is in wood, so it could easily be taken down. The hut is supported on great wooden piles, and approached by a sort of ladder. Such a state of things only exists in Catholic countries, and the more Catholic — as, for example, Belgium and Spain — the more complete the desecration.

The havoc made in the interior of the church by the eighteenth-century architects is deplorable. Windows have been destroyed, piers have been stuccoed over, and pointed arches turned into round ones. The pillars are late Perpendicular, or rather Flamboyant shafts without capitals. But around the nave, between the arches and the clerestory, runs a little frieze of foliage and quaint birds and beasts, a feature which is not common. All the bosses of the choir and apse are very richly decorated, and the vaulting is good, but both the choir and the *chevet* have been sadly "improved." About 1753 the brothers Slodtz were commissioned to convert the thirteen pointed arches of the choir into round ones, and to encase the pillars in panellings of stucco, which was marbled and gilt, the last bay being profusely decorated with golden sun-rays. One of these unfortunate brothers, Michel-Angelo by name, designed the pulpit, a mass of palm-tree decoration, surmounted by a female figure of Religion; and to place this, a whole bay of the nave had to be demolished. The year following three chapels were destroyed to make room for the new square, barn-like chapel of the Communion. The modest sum paid these miserable, so-called artists, for hacking the church to pieces, was 50,000 *écus*.

The crypt is most interesting, and is said to have been a reproduction of the original one. It was used for some time as a workshop, by the cleaners of the church, and was the depository of brooms, brushes and lamps. It has a stumpy central column, from which spring the ribs of the vault; and the capital is ornamented with vine-leaves. The crypt is square, divided into four parts. A few remains of recumbent tombs can be seen in the pavement; but of the monuments of Arnaud de Pomponne, ambassador of Louis XIV, and of Jean Chapelain, the author of "*La Pucelle*," nothing remains. The crypt, with its solid central pillar resembles that in the Louvre, of Philippe Auguste, lately brought to light. The famous mosaic Madonna, by master David, which Jean de Ganay, a parishioner of St. Merri, brought from Florence in 1496, is now in the Hôtel Cluny.

Much of the old glass has gone, the central portion of each window having been taken away, to throw more light upon the marbled stucco. What remains is in good sixteenth-century style, the work, probably, of Héron, Jacques de Paroy, Chamm, and Nogare, whom Leveil records to have been the artists employed. The subjects are from the history of SS. Peter, Joseph, John the Baptist, and St. Francis of Assisi; but it is most difficult to follow the designs, as not only are there the gaps of plain glass, but what was taken out has been used for repairing the others.

The church possesses a very curious holy-water stoop, of the time of Louis XII. It is about three feet high, octagonal, upon a slender shaft which stands upon a square base. The upper part is decorated with the arms of France and of Bretagne, and the instruments of the Passion. It is as large as a small font, and far more like one than a stoop. A small amount of carved woodwork (Renaissance) remains; fragments of stalls, sculptured columns, pilasters, children, birds, and so on, and a wondrous sixteenth-century painting on wood, representing St. Geneviève sitting in a sort of Druidical circle surrounded by her flock. It is the only combination I can remember seeing of the mystic circle of stones of Paganism and a Christian saint.

ST. SÉVERIN.

St. Séverin is particularly interesting as showing a gradual development from the thirteenth to the sixteenth century. Founded on the site of an oratory by Henri I in 1050, it was rebuilt at the end of the eleventh century. There were two Saints Séverin; one, the founder of the abbey of Châteaulandon, who miraculously cured King Clovis by placing his chasuble upon him; and the patron of this church, who was a monk, or rather a hermit, living in the sixth century during the reign of Childebert I; he dwelt as a recluse in a hermitage at Paris, and gave himself up to pious exercises, and prayers, and supplications. Considering the brutal manners and customs of these early kings and their friends, it is a blessed thing that some of their contemporaries cared for other matters than fire and sword and pillage. St. Séverin was one of these; and so well did he preach his pacific faith that St. Cloud or Clodoaldus, the grandson of Queen Clotilda, became a disciple, and received the religious habit from him. St. Cloud was the youngest of three brothers. Wicked uncles murdered the elder two, but Clodoaldus managed to escape their wrath. What brigands they all were! Imagine a woman having to decide whether her grandsons should become monks or die? No wonder monasteries flourished, for where else was there any culture, or enlightenment, or civilization? And yet Clotilda must have had a reason for her passionate answer, "Better they were dead than shaven monks"!

St. Séverin was probably buried near the oratory, and what more natural than that the disciple should consecrate the spot to the memory of his master? In 1050 Henri I gave up the patronage of the foundation which had, before that time, belonged to the kings, his predecessors, to the then Bishop of Paris, Imbert. At the end of the eleventh century it was the headquarters of an enormous parish extending almost over the whole of the southern side of the city. It is now in the midst of the Italian population, models, organ-grinders, plaster-image sellers, and others; and it is a pretty sight on Sundays and fête days to see the church filled with the inhabitants of the sunny south decked out in their holiday attire. How a group of people alter the whole aspect of affairs, I had once brought before me most vividly in St. Paul's, London. Walking down that very dismal nave, it seemed suddenly to be quite lighted up by a foreground group of three Italian women and some little children dressed in violet, emerald-green, and crude blue garments — hideous colors by themselves, but allied to the snow-white chemises and trimmed with gold braid, they seemed to completely change the appearance of the church, and put it right. St. Paul's is essentially Italian, and thus, under the London gloomy sky, and decorated with men and women clad in blacks and browns, it is utterly *dépaysé*.

The present church of St. Séverin was reconstructed in the thirteenth century. In 1347, and again in 1458, the Pope accorded indulgences to the faithful who contributed to the church building-fund. The first stone of the new part was laid in 1489, and the chapel of St. Sebastian was built three years later. In 1490 the chapel of the Conception was demolished to make way for the enlargement of the aisle. In 1495 Jean Simon, bishop of Paris, consecrated the new portion of the church — the high altar, and many of the side chapels. In 1498 the chapels on the south side were commenced by Micheaul le Gros; the sacristy was added in 1540, and the chapel of the Communion in 1673. Thus, for four hundred years the church was undergoing constant change and development. Then began the downward path, commencing with the destruction of the *jubé* and the ornamentation of the sanctuary in the style of St. Merri. Originally, many of the Paris churches had *jubés*, a species of rood-screen, but the only one now remaining is that of St. Etienne du Mont.

Were it not for the elegant little tower and spire few persons would know of the existence of St. Séverin. It is out of the beaten track, beyond Notre Dame, and the "monuments" of the Faubourg St. Germain. It has to be hunted up — but it is well worth the trouble, and any one visiting the arena in the Rue Monge (the remains of the Roman occupation of Lutece) can see it at the same time. On the stylobate of the portal is a strange inscription, or rather the remains of one, in the thirteenth-century letters, giving the divers duties of the grave-diggers; amongst others, the cleansing of all the vaults (of the roof), and all the rest of the church on the festival of St. Martin, as the dedication festival fell two days after. It is a pity that restorations have almost destroyed this relic of a Mediæval epigraphe. As in many other churches there are two lions on each side of the arch, probably the supports formerly of some heraldic shields; this, no doubt, is the origin of the formula, which terminates certain ecclesiastical judgments pronounced at the threshold of the temple; *datum inter duos leones.* The tympanum bas-relief has been restored;

it represents the charity of St. Martin, who is one of the patrons of the church, and whose mutilated mantle, or a portion of it, has been one of the cherished relics of St. Séverin since the fourteenth century. There is also a chapel dedicated to the venerable and self-denying bishop of Tours, which was formerly completely covered with *ex-voto* horse-shoes, the gifts of thankful travellers; for St. Martin, having been on horseback when he divided his cloak, became the patron of the travelling community. The western façade is composed of portions of the portal of St. Pierre aux Bœufs in the Cité, which was demolished in 1837, and is, the little which has been left unrestored, of the thirteenth century. The whole belt of chapels, as well as the greater part of the nave, is of the fifteenth and sixteenth centuries. The first three bays of the nave are of a totally different style; the form of the arches and of the windows show the work of thirteenth-century architects. At the northwest angle of the chapels an elegantly-carved niche, with a canopy, encloses the patron saint bearing a crozier in his hand. Above and around him are gargoyles of grotesque animals and birds, while near him is an inscription inviting the passers-by to pray for the souls of the departed.

Bonnes gens qui p cy passes
Pries Dieu pour les trespasses.

The last word has been mutilated — perhaps by the hands of the Huguenots.

The interior consists of a nave and double aisles. The triforium is very similar to that of Westminster Abbey church; but at the commencement of the choir, the thirteenth-century arches have been filled up and the pillars marbled over into piers. Some of the capitals and corbels of the south side aisle are most odd — prophets, flying angels, and animals grinning from behind foliage, like the carved miserere seats in Gothic churches. During the reign of Henri IV sibyls and prophets, patriarchs and apostles were painted by one Jacques Bunel on a gold ground above the arches of the nave; but, happily, they have disappeared. It was Michael de Montpensier who caused the marbling of the choir to be undertaken in 1684, and who also bore the expense of the baldichino of the altar. Tubi was the sculptor, Lebrun supplied the designs.

In the side aisle, on the south, is a little door leading through a garden, formerly the graveyard, to the *presbytère*. This, in summer, forms a charming little picture. In one of the side chapels is a fifteen-century wall-painting of the Resurrection of the Dead; and in the chapel of the *chevet* a preaching of St. John the Baptist, also in fresco. In the apse are a series of fluted and spiral columns. The bosses are many of them ornamented with figures — the Annunciation, St. Anne and St. Joachim at the golden gate, a holy face, and a chalice surmounted by the host.

There are only three ancient epitaphs remaining — that of Nicholas de Bomont, who died in 1540; Guillaume Fusée, president of the Parliament of Paris, and of his wife, Jeanne Desportes, who made several pious foundations in 1521; and Jean Baptiste Altin, conseilleur au châtelet, who died in 1640. The first, Nicholas Bomont, his wife, and fifteen children are represented as pigmy personages praying at the foot of the crucified. The emblems on Altin's are singular, as having been borrowed from the symbolism of the catacombs. A modern inscription relates that the first confraternity established in France, was at St. Séverin, in 1311, under the name of the Immaculate Conception. The organ and iron gallery are handsome, but only date back to 1747, having replaced earlier ones of 1512; but the first instrument was given in 1358 by Master Regnaud de Douy, governor of the great schools of the parish: it was *une bones orgues et bien ordenées.* The glass is all of the fifteenth and sixteenth centuries, and not in any way remarkable. Amongst the subjects is a St. Thomas-à-Becket celebrating his last mass, surrounded by his murderers; this sainted martyr having a chapel dedicated to his memory in St. Séverin. There are several modern pictures in the chapels, two by Flandrin, but not in his best style; we must go to St. Vincent de Paul to see his master-pieces. S. Beale.

ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE ROTCH TRAVELLING-SCHOLARSHIP DRAWINGS. — PLATES XLIII, XLIV, XLV.

[Issued only with the Imperial edition.]

CAPE COD SKETCHES NO. 4. — THE HOUSE OF CAPT. JOHN KENDRICK.

THE early days of John Kendrick the builder, and for a time, occupant of this house, are veiled in obscurity, further than that he was a Cape Coder. That he built and lived in the house is an historic fact, and that he was a distinguished navigator is beyond all question, making foreign voyages from whence he brought many costly furnishings for his house, which in itself to-day shows a type of ancient foreign order of architectural designs — the old German tile around the old open fireplace, etc. In the year 1787, some enterprising Boston merchants, Borsell, Brown, Bulfinch, Darby and Pintard, conceived the idea of establishing a trade on the Northwest Coast, consequently they fitted out the ship "*Columbia*" of two hundred and twenty tons, and the sloop "*Washington*" of ninety tons, and loaded them with blankets, iron bars, knives, copper pans, etc., for trade with the Indians. John Kendrick commanded the "*Columbia*" and the expedition, and Robert Gray commanded the "*Washington.*" At the time copper medals were struck off, representing the ship and sloop, with Capt. John Kendrick's name on one side, and the name of the owners on the other. The expedition sailed from Boston on the 30th of September, 1787. On the 17th of September, 1788, an opening was discovered on the coast, which proved to be a great river, to which Captain Kendrick gave the name of the Columbia River (the name of his ship), and it was here that the sloop grounded and was boarded by the natives, and several of the crew were murdered. Shortly after this occurrence, Captain Gray was transferred to the "*Columbia,*" and at once sailed for Boston by the way of Canton, leaving Kendrick on the coast in charge of the sloop, and it was thus that the ship "*Columbia,*" of Boston, carried[1] for the first time the American flag *around the world.* The "*Columbia*" and the "*Washington*" were the first American vessels that ever visited the northwest coast. Captain Kendrick remained on the coast until the return of the "*Columbia,*" Captain Gray, from Boston, when they set sail for the Sandwich Islands, where he opened the first traffic with the natives for sandal wood, etc. In the year 1793, the brave Captain Kendrick was murdered by the natives, and thus ended the career of a brave and brilliant man of that period.

It was said of Captain Kendrick by his neighbors, that he loved, and was also liberal with his choice wines which he brought from foreign lands, and when at his Wareham home he was daily seated in the front hall of his dwelling with open doors at eleven and four o'clock, and would hail all passers by to step in and help him "splice the main brace." Many anecdotes in days gone by were related concerning Captain Kendriek, and we will relate one to demonstrate the extremes of the characters of man and wife, Captain Kendrick possessing almost an ungovernable passion, while his wife was gentle, lovingly mild and amiable.

The Captain one day was fixing matters around the fire preparatory to taking a drink, while his wife was at the same time using the embers for heating her flat-irons, when something displeased the Captain, he took one of the irons from the hearth, and hurled it through a large elegant French mirror, dashing it in myriads of pieces, when Madam admonished him thus, gently, "Why, my dear Captain, I fear you have broken the handle of my *flat-iron.*"

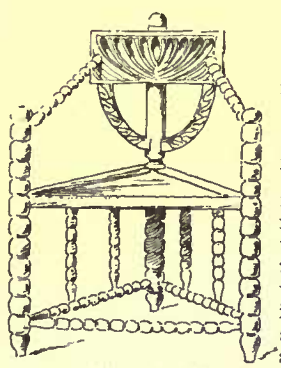
HOTEL AT FOREST GLEN PARK, NEAR WASHINGTON, D. C. MR. F. SCHNEIDER, ARCHITECT, WASHINGTON, D. C.

HOUSE OF SOL. SMITH RUSSELL, ESQ., MINNEAPOLIS, MINN. MESSRS. WAITT & CUTTER, ARCHITECTS, BOSTON, MASS.

COUNTRY HOUSE. MR. R. H. ROBERTSON, ARCHITECT, NEW YORK, N.Y.

PROPOSED HOUSE AT FLATBUSH, L. I. MESSRS. STUCKERT & DIETRICH, ARCHITECTS, NEW YORK, N. Y.

UTILIZATION OF TOWN SEWAGE BY IRRIGATION.[2]—II.


AN OLD WARWICKSHIRE CHAIR.

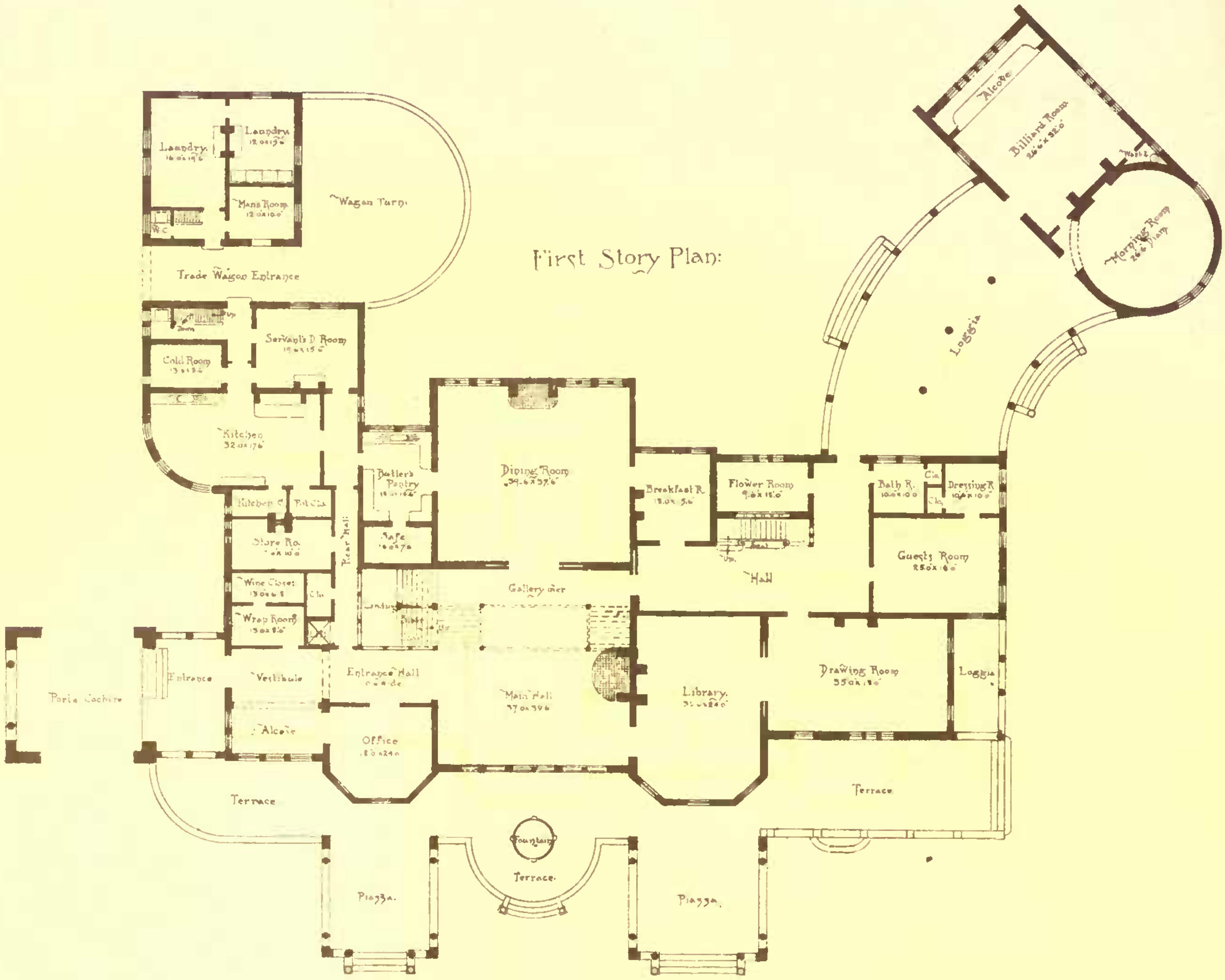
I WILL now give you my experience as to the proper crops for a sewage-farm. They are simply rye grass and roots, with a crop of cereals once in six or seven years, and whilst cereals are under cultivation, no sewage should be applied to the land at all. The soil having been prepared, as I mentioned in describing the character of the carriers and the pickups, it should be sewn with rye grass in the early autumn, so that the young plant may be fairly developed before the frosts of winter set in. It may be treated as I have described, with five thousand tons of sewage per acre per annum. It will enable the manager to take at least five crops off that field in the ensuing year, and if the season is a warm one, sometimes six or seven. Sewage-farmers sometimes ignore the fact that rye grass is a biennial, not a perennial plant, and that if it be allowed to get well into flower, it will cease to provide more green material, and the sewage will not be purified to the extent that would be the case if the plant be cut as soon as there is the slightest appearance of flower in the field. If this treatment is steadily pursued, the cropping may go on for two years, or even for a third year, but that is all. If, however, the rye grass be allowed to go into flower, the field will be useless for next year's work. I have seen a farm of two hundred acres of rye grass, with one hundred and fifty quite useless for the purpose, because the managers had cut off the demand for grass by absurd arrangements, and as they could not sell it, they would not go to the expense of mowing, and allowed the whole crop of the ensuing year to be entirely lost by seeding. The local authorities

[1] See "*The Northwest Coast,*" by James G. Swan, and "*Oregon,*" by Gustavus Hines.

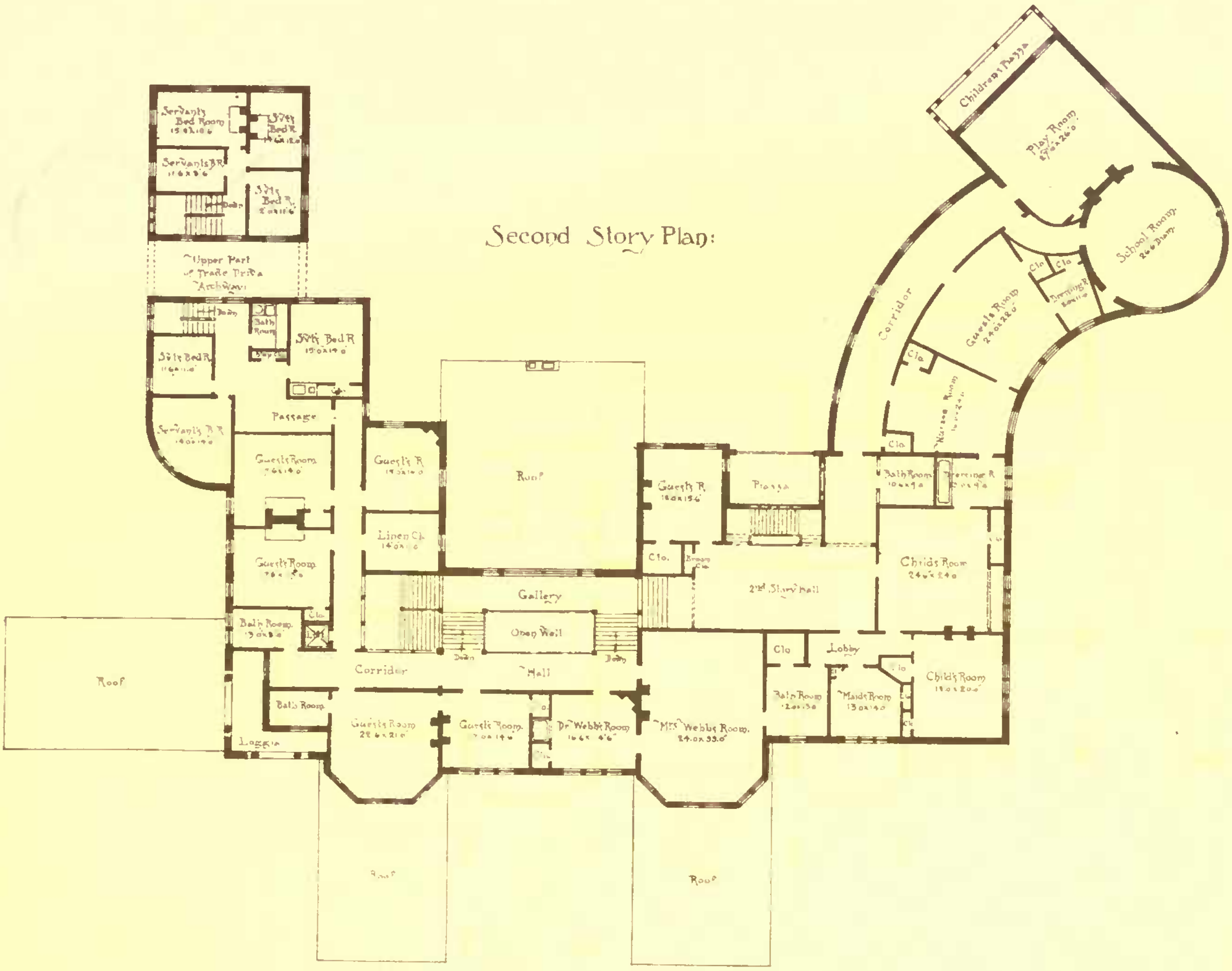
[2] A paper read before the Society of Arts by Alfred Carpenter, M. D., M. R. C. P., London, and published in the *Journal of the Society of Arts.* Continued from page 127, No. 585.

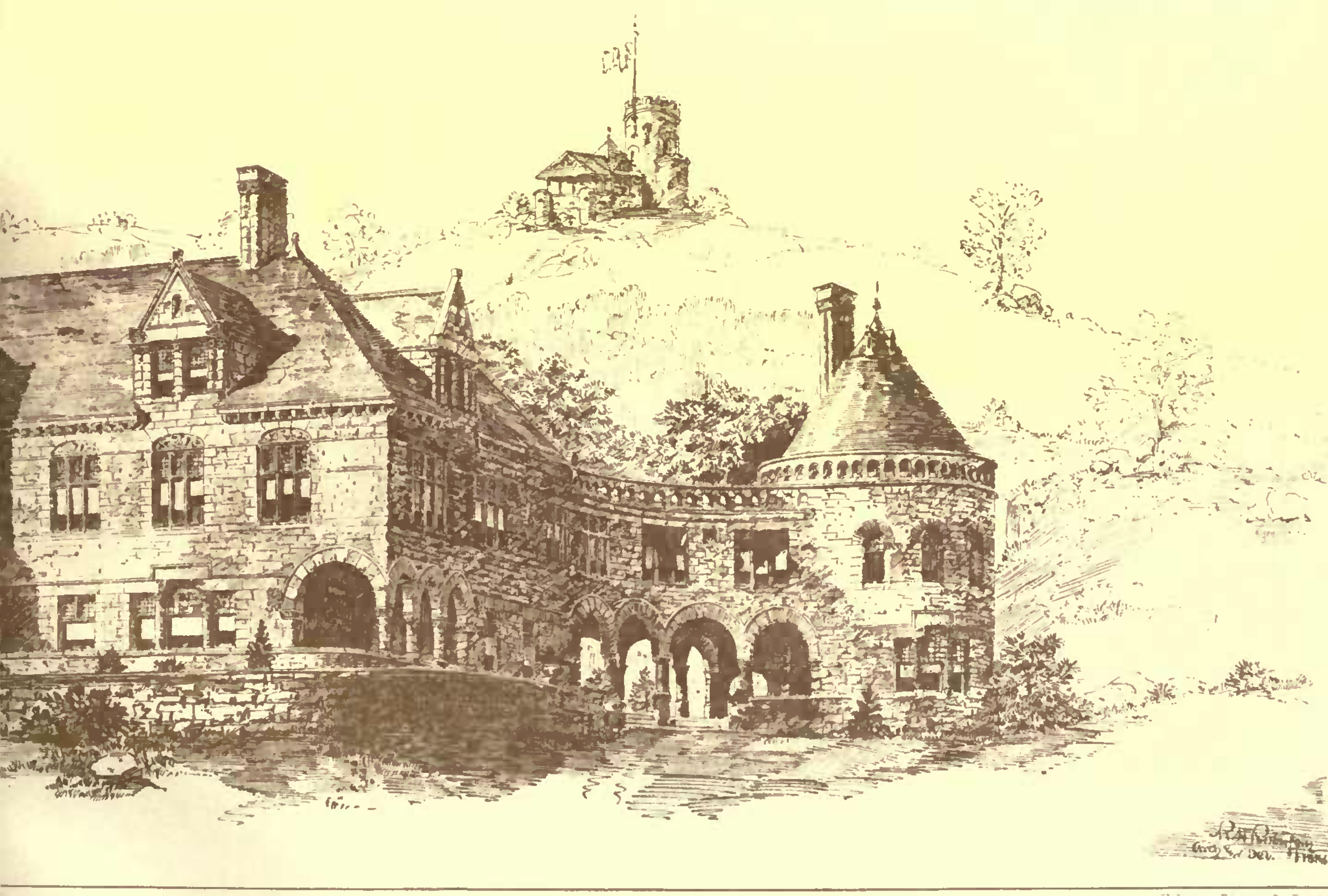


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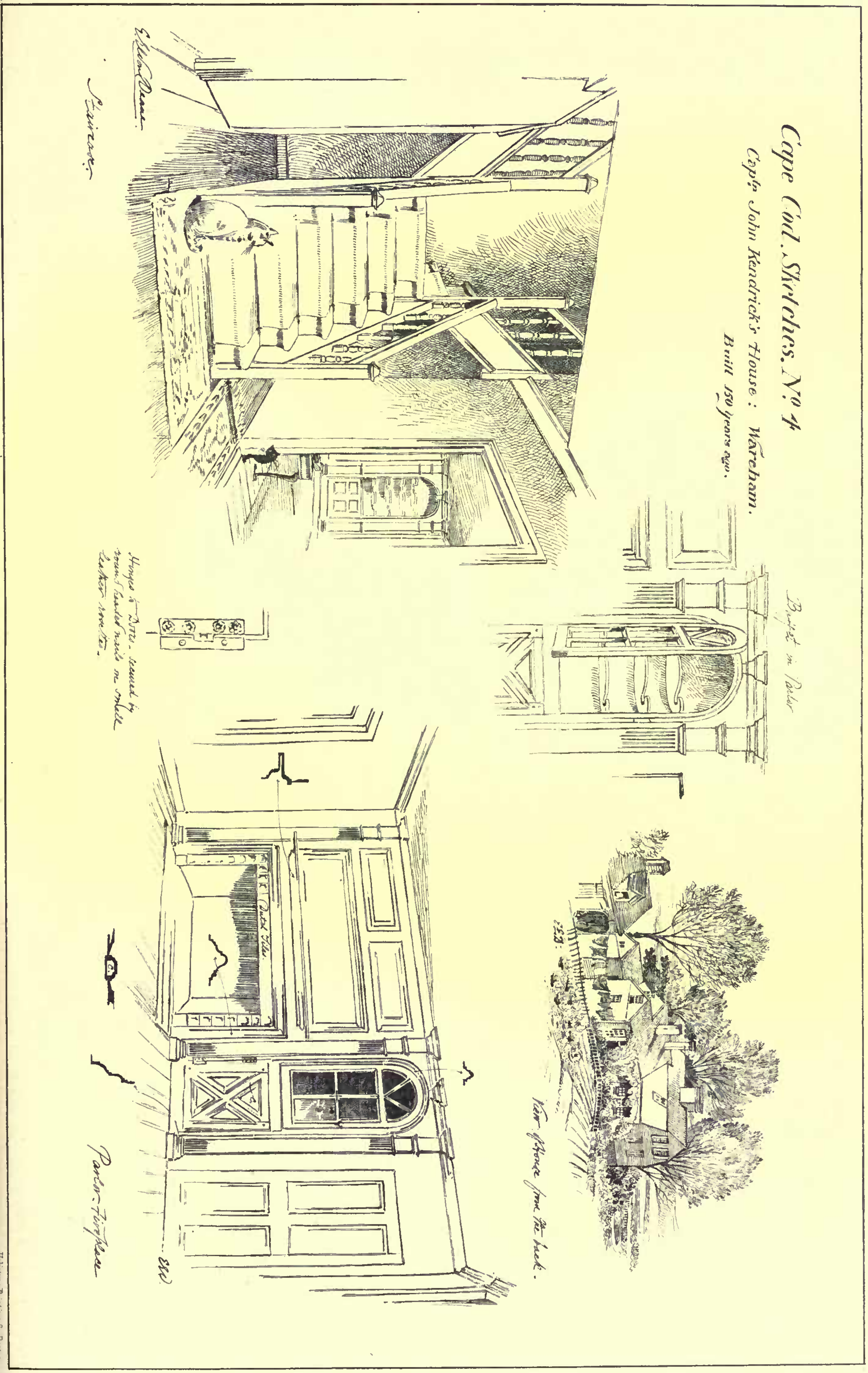

First Story Plan:
Laundry
Laundry
Mans Room
W.C.
Wagon Turn
Trade Wagon Entrance
Servant's D. Room
Cold Room
Kitchen
Butler's Pantry
Safe
Dining Room
Breakfast R.
Flower Room
Bath R.
Dressing R.
Guests Room
Hall
Gallery over
Store Rm
Wine Closet
Wrap Room
Rear Hall
Porte Cochere
Entrance
Vestibule
Alcove
Entrance Hall
Office
Main Hall
Library
Drawing Room
Loggia
Terrace
Fountain
Terrace
Piazza
Piazza
Terrace
Loggia
Alcove
Billiard Room
Morning Room

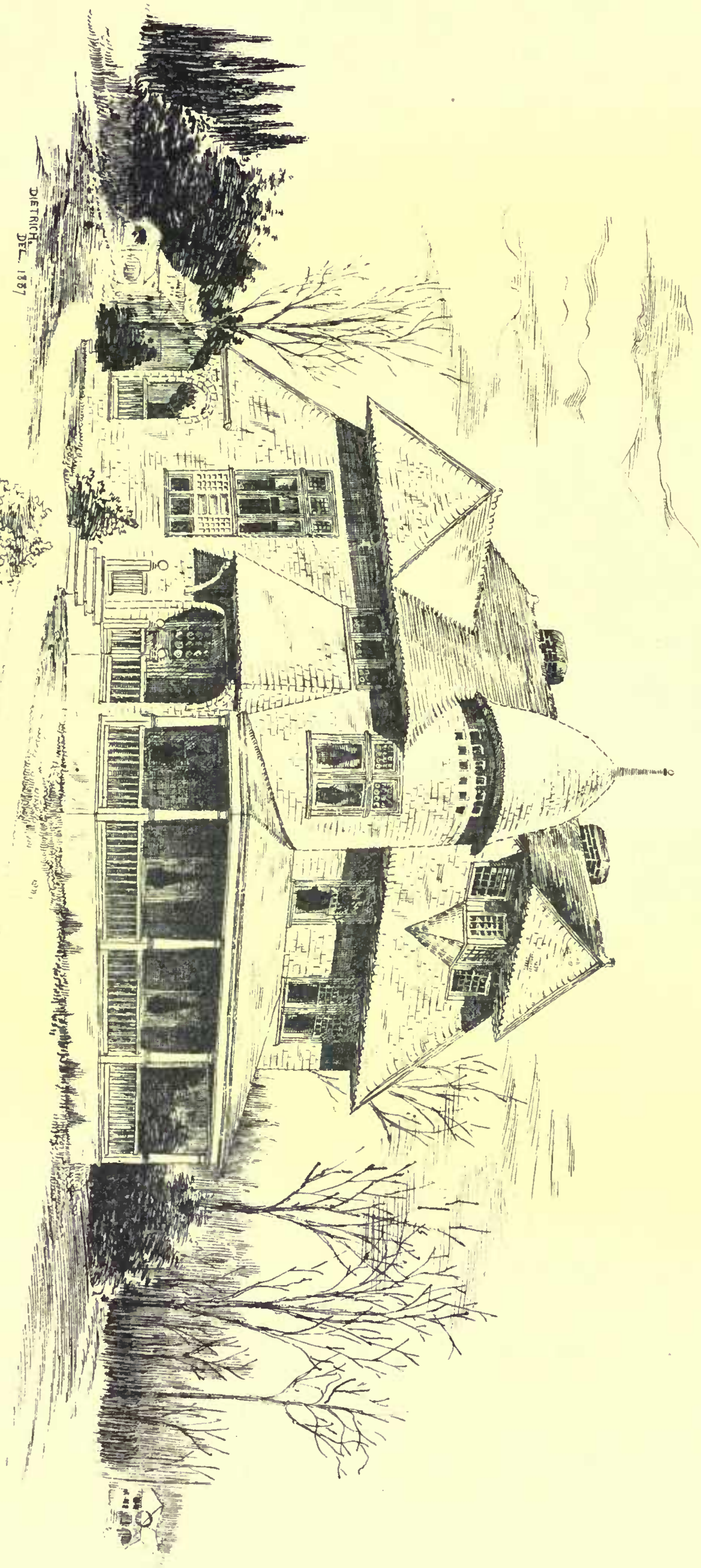






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Cape Cod. Sketches. No 4
Capt. John Kendrick's House: Wareham.
Built 150 years ago.
Staircase.
Buffet in Parlor
View of House from the back.
Parlor-Fireplace



Proposed House at Flatbush, L.I.

A. M. STUCKERT, E. G. W. DIETRICH, ARCHITECTS.
294 BROADWAY, NEW YORK

Heliotype Printing Co. Boston

who were managing the farm at that time were also paying £10 per acre as rental for that land. It was no wonder that, with such management, the financial results were unsatisfactory, and the effluent not so pure as it ought to have been. Under the plans I have pointed out as the right principle to be adopted, I have known twelve tons of grass to be taken from a given area, and, within one month afterwards, a similar amount from the same plot, but this was when the season had been continuously warm. I should be fairly satisfied with an average of eight tons per cutting per acre.

Why do I prefer rye grass? Because it is a carniverous plant, digesting the animal matters presented to it, just as Darwin has described the action of the Drosera, or Sundew, upon the poor little fly which is caught in its embraces, or the action of the Amæba upon the organic remains which it may have surrounded in its outer membrane, turned for the occasion into a stomach. The plant acts at once upon the material without its being necessary for the organic matter to be reduced to lifeless salts before it is assimilated. I am bold enough to differ on this point with one of the greatest chemical authorities of our age, viz., Liebig. I do so because I watched, some years ago, with some interest, the action of various juices upon growing plants. I planted rye-grass seed in well-washed sand, and kept it under glass receivers, feeding one series of plants (after growth consequent upon pabulum in the seed itself, had ceased) with simple distilled waters, others with milk or beef-tea in weak solutions, others with fresh urine, others with stinking sewage, others with solutions of salts, which would represent the quantities of those materials contained in the various organic or animal juices that I used. Those fed with distilled waters remained all but stationary; those fed with fresh milk, fresh juices of meat, and other unchanged animal substances, grew much more rapidly than those fed with the nitrate of ammonia and phosphate salts. There was a marked difference between the sets of plants at the end of a week in favor of the *fresh* organic material, though in all other circumstances they were treated precisely the same. It appeared to me as if the carniverous plant was able to assimilate the animal juices much more immediately than the other matters, whilst those fed with stinking sewage did not grow at all in the time, any more than those fed with distilled water, and those treated by phosphates and artificial manures required more time to assimilate the material supplied to them, and at first grew more slowly. From the result of these experiments I am of opinion that it is not necessary for organic material to be reduced to its simple elements, and turned into ammonia and phosphatic salts before the plant can assimilate the material presented to it. It was apparent that if fermentative changes had begun, there was delay in assimilation; I account for that delay by the time required by the micro-organisms contained in putrefying sewage to complete the work of disintegration in which they are engaged. The process of assimilation was in that case slower than when the material was ready, as organized matter, to be absorbed and fixed in the tissues of the plant.

It is acknowledged that there is no known chemical difference between the albumen and the fibrine of vegetable matter as compared with that of animals. It appears to me that it would be a clumsy process if nature had to disintegrate matter into its original non-vital elements for the purpose of returning it to a similar organized state again; but I can understand that it is necessary, when the disintegrating process has begun in consequence of the activity of bacterial life, for that disintegration to be completed before the vegetable cell can deal with the matter presented to it. In fact, some of the plants fed with stinking sewage, in which putrefaction was not complete, did grow more rapidly than others, and I impute this to the probability that the plant fed upon the bacteria in the stuff, not on the salts. It is in the power of vegetable cell life to deal with fresh sewage in a more rapid manner than it can with that which is already putrefying, which is the keystone to success in sewage-farming. It is the principle which local authorities must attain to, if they wish for good financial results. When local authorities, therefore, complain of a decided loss upon sewage operations in a balance-sheet (excluding engineering difficulties), and whilst acknowledging the efficiency of irrigation in preventing river pollution, they are most likely allowing bacterial or fungoid life to destroy the fertilizing power contained in the sewage, and delivering it in stinking condition upon the land. But, as I have said before, these are no reasons for abandoning sewage-irrigation, because it has been repeatedly shown that the application of stinking sewage to land is not a part of the process to be entertained, and it is not a part of correct sanitary organization to allow sewers to exist in a town as sewers of deposit.

I think that osier beds, as a part of the cropping of a sewage-farm, are a mistake. Such beds may be planted in situations which cannot be kept properly dry, by reason of its being the bed of an old pond or an old water-course, or because it is invaded by effluent, but to lay out a farm with osier fields would be sanitarily a mistake. Osiers make good borders to sewage-fields, as belts around them, but they should only be used for protection, not for the absolute utilization of sewage, for it is impossible for them to produce the weight of crop required. So also with ordinary grass or meadow land. It is very well to have meadows capable of being sewaged when there is excess of storm waters, or when the effluent, having been applied to a newly-prepared plot, is not so clear as could be wished. It is then prudent to pass it over a meadow before it is sent away from the farm. These meadows should also be at the lower part of the farm, and the farthest away from the first delivery of sewage, so that crude sewage does not reach them. If fields are continuously sewaged, the ordinary meadow grass is destroyed, and water grasses only develop, which are not nearly so useful as rye grass, and when so used, the plot lessens the power of the farm to deal with the purification of the water and the utilization of the sewage itself. Osier beds and water meadows should be only adjuncts to a sewage-farm, unless the area is unlimited.

The possibility of the production of the liver fluke (*Distoma hepaticum*) in sheep, a disease causing great fatality, is used as an objection to sewage-farming by Dr. Tidy.

There are times in the year, such as the early spring, when feed is exceedingly plentiful on the farm, and the season dry, when it may be allowable to put a flock of sheep for a week or two upon the fields which have not been recently sewaged, and which it is proposed to break up in the middle of the year; but a manager who habitually feeds sheep upon a sewage-farm is doing that which no sensible farmer would be likely to do — put sheep upon wet meadow land. Those who understood sheep-farming only choose dry and open areas for the growth of mutton, with fine short grass, not the free-growing plants which flourish on irrigated meadows. The possibility is no danger to irrigation. If sheep-feeding is adopted, it shows that the manager does not understand his business.

I have said that it is the best plan to take a crop of roots from the land when the rye grass is broken up. The process of breaking up the land is an important one, and must not be delayed beyond the end of the third year. If the crop of grass seems in the third year to be failing, the land should be broken up in the middle of the year, or early in the autumn, and a crop of cabbages (or collards) taken off, leaving the ground ready for mangolds in the following spring. The land must not be sewaged in the same manner as when rye grass was growing upon it. The cabbage and mangold plants will take the sewage very well whilst they are young, and occasionally, as they approach maturity, it will be useful if the weather be dry; but the soil is not to be dressed so frequently as was the case with rye grass, although the arable land, whilst fallow, before the plants have been put in, or whilst they are very young, will bear frequent dressings of sewage, and the soil will fix a considerable amount of fertilizing matter in its humus, and hold it, if the weather be cold, until it is wanted. It will be retained until the roots of the growing plants extract it from the embraces of the soil. I cannot agree with Mr. Bailey Denton as to the superiority of roots over rye grass. Roots should only be used to assist in exhausting the soil of the materials which the rye grass had not taken out.

Cereals are not to be encouraged upon a sewage-farm oftener than once in from six to ten years. The sowing must be dependent, to some extent, upon the season. If the mangolds have been clamped early, so that the ground can be prepared for a crop of wheat, that cereal may be sown if season will allow. I have had some of the finest wheat from the Beddington farm that has ever been produced. We had six to seven quarters to the acre; some of it, grown twelve years ago, is on the table, and I think that will speak for itself; but no sewage must be applied after the sowing is completed, for this reason: cereals cripple a narrow area. If the wheat is not sown until the spring, it allows of the use of the fields for frequent dressings in the winter seasons. As a rule, oats are preferable to wheat, as there is abundance of straw, and excellent crops of oats are obtainable which may be used on the farm. The straw works up well as forage for the cattle in the winter time, and it is advantageous on heavy land to dress it with long manure for cereal crops, as the decay of the straw allows of the subsoil being made more porous. I am almost afraid to give a little hearsay evidence as to the growth of rhubarb at Aldershot. I know that we had immense crops from four acres at Beddington, and had no difficulty of disposing of the produce. We did not continue it, not because of the flavor — which had only a "sewage twang" in the imagination of Dr. Tidy's informant — but because it did not utilize the quantity of sewage which the land had to deal with, for it could not be and was not sewaged whilst the crop was being perfected and collected. Rhubarb is somewhat out of place in a sewage-farm. I was told that the Aldershot rhubarb, of which there were eleven acres at the Camp farm, made a champagne of the finest brand, at a cost of about 1*s.* a bottle. I do not advocate market-gardening of any kind, though I have seen all kinds of fruit and vegetables grown in the greatest perfection. Strawberries and raspberries, which would have been a credit to any table, and with unsurpassed flavor, whilst the smell of violets, onions, sage and other plants with strong odors were so manifest that any one walking with his eyes shut could tell the kind of crop by the odors of the crop as he passed along the gardens in which the sewage was actually being used at the time of the visit. Whatever odors the sewage might have caused, they were utterly unable to overcome the natural smell of the spring violets in Mr. Stedman's fields whilst he was taking sewage from the Beddington Farm, and the odor of his strawberries were well known and appreciated in the London markets, where he had no difficulty in disposing of his very satisfactory crop. But market-gardening does not answer for sewage-farms, because the area cannot take the sewage which has to be utilized, and when the market-gardener wanted the sewage most, the sewage-farmer could not spare it. The result was a difficulty between the two which led the managers to discontinue the supply to Mr. Stedman's market-garden. We also discontinued market-gardening for other reasons. The sewage had to be utilized, and the

area was too contracted to allow of so much being out of use at the very time when the largest area was required to deal with the Croydon sewage. I give these facts as reasons why sewage-farmers should not engage in market-gardening unless they have a very extensive area of land to deal with. Voelcker condemned market-gardening on sewage-farms for these reasons, and not because "sewage clogs the soil."

Let us now pass to the value of the crops upon farms irrigated with sewage. Dr. Tidy says that sewage produce is best described "as dropsical." He says, "it is difficult to dry, and prone to decompose," and quotes Voelcker as stating that it does not yield so nutritious a product as natural pasture. "If," he says, "you want good produce, you must be content with small quantity." This is an argument which may be as fairly applied to the produce which nature supplies to all regions in which there is a heavy rainfall, to the Valley of the Nile, for instance, as to sewage-farms. Dr. Tidy gives a table containing the percentage composition of dry substances obtained from plots, one of which was not sewaged, and the other three sewaged from 1,000 to 9,000 tons per acre. The same argument has been advanced by other objectors, and I have exposed its fallacy over and over again.

The principal deficiency, as shown in Dr. Tidy's table, is in non-nitrogenous matters; it is very slightly deficient in woody matter, whilst there is an increase in the mineral, fatty and nitrogenous constituents. Dr. Tidy's error is in taking a sample and analyzing that, without reference to the quantity produced from the area treated. Multiply the sample analyzed by four — for that will be about the difference in the weight of the produce — and you will get very different results, the total quantity of sugar produced being very much larger than was the case from his unsewaged meadow. Notwithstanding this sugar, the fattening power of sewage-grass is depreciated by Dr. Tidy. If he means that it will not produce the unwieldy and unhealthy cattle that one sees at the Christmas cattle show, I quite agree with him. I do not think that the production of such cattle is to be encouraged; but I do know that bullocks grown upon a sewage-farm do give a meat which is free from the loathsome quantity of fat which other food will produce, and which appears to me only to benefit the cook and the rag-and-bone shop at which she sells the produce of her dripping-pan, to the injury of her master and the increase of his butcher's bill. The meat from sewage-fed cattle is not loaded with fat, but it is solid, substantial meat, of good flavor, and does not waste nearly so much in the cook's hands as fat meat usually does. I have repeatedly tried it, and I know that it is very digestible and satisfactory as a diet, and so the guests have found who have fed upon sewage-grown beef, at my own house and at Beddington.

The experiments adduced by Dr. Tidy with milch cows do not exactly correspond with other evidence. He acknowledges that the chemical analysis of the milk from cows fed on sewaged or unsewaged grass does not indicate any material difference. I thank him for this addition, as it renders it unnecessary for me to republish in detail the analysis, made by a very eminent chemist, of milk taken from fifteen sewage-fed cows, and which was published in *Bell's Weekly Messenger* five years ago. Those analyses were made of milk taken by the analyst's agent, without notice of his proposed presence at the farm. He came to me without notice, and I took him, with his bottles to Beddington, he saw the cows milked, and he took the milk away with him, not a single person being aware of the possibility of his advent until he appeared. I am justified in republishing the average of the whole number, which will show how highly satisfactory the result was to the managers of the farm, and to the produce of cows fed entirely upon Italian rye grass. Wanklyn gives, as his average, for the guidance of analysts:

Solids, not fat	9.3
Fat	3.2
Water	87.5

The average of those fifteen cows to which I have referred is:

Specific gravity	1030.05
Percentage of cream	15.5
Solids .... { Not fat .... 9.26 / Fat .... 4.96 }	14.21
Ash	.64
Chlorine	.065

There was one cow only in the whole list which was comparatively low, the reason for which was not apparent, otherwise the average would have been higher. We were unable to identify the particular cow, so did not discover the reason for the deficiency of cream which certainly existed in the milk from that one cow. The cows milked were the whole of the animals in one of the sheds, and in no way differed from the sixty which at that time were fed upon the farm.

I have to apologize to the members of this Society, and also to Dr. Tidy, for so often referring to his paper, but as that is the *raison d'être* of my presence here to-night, I must continue to follow him. His next description is that of surface-irrigation. He does not think that the sanitary aspect of the question is in accord with the agricultural. Again he has misunderstood the whole subject. If there is not a sanitary success, it is quite impossible for there to be a financial one. They are linked together in one way, though it is possible to be a sanitary success, although not necessarily so financially; but the *vice versâ* cannot arise. Dr. Tidy has taken the evidence afforded by persons who knew nothing of sewage-farming, as evidence against the plan; when he asserts that the sewage of two persons applied to an area of land can, in any way, be considered as of any use in settling the question, he shows the weakness of the evidence he adduces. That afforded by the Earl of Essex is much more to the point. I have no doubt that a well-laid-out field will take and deal with from 5,000 to 10,000 tons of ordinary town-sewage per annum, according to its retentive or non-retentive character, provided the quantity of material taken off corresponds with that which has been put on, viz., at least forty tons of produce for each 5,000 tons of fresh town-sewage; this will be the sewage of from 100 to 200 persons per acre. Dr. Tidy, says however, that a minimum of 100 equalling an application of about 4,000 tons of sewage is necessary to pay, whilst thirty is the maximum to escape prosecution. I am unable to find a single instance in which such a prosecution has taken place, as will be seen in the report annexed, though immediately before he states, upon the evidence of Professor Robinson, that in nineteen towns in which irrigation is practised the average number of persons provided is for 1.37 per acre. All these nineteen ought to have a prosecution carried out to a successful issue if there is any foundation for Dr. Tidy's opinion, viz., that the sewage of thirty persons to the acre will be the maximum capable of being utilized if the town is to escape prosecution.

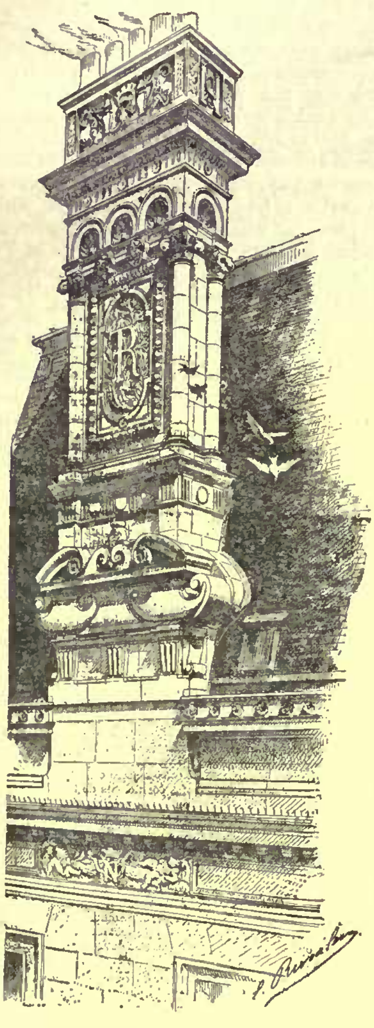
In the years 1876 and 1877, this Society published a *resumé* of returns from thirty-seven different towns in the kingdom, then utilizing their sewage by irrigation; I give the results, as far as I have been able to get them, of the practice still followed in those towns. If Dr. Tidy's statement is correct, we shall have evidence of successful prosecution and arrest of process. I, however, do not find a single case which supports the view he so forcibly expressed in his paper upon this point, and I am at a loss to know upon what grounds he submitted it to this Society.

I cannot pass by intermittent downward filtration without further comment, though I have already stated my own views regarding it. The process is one qualified to provide against river pollution by oxidizing the organic material in sewage, and rendering it safe for transmission by river-carriage. It is to some extent a necessary adjunct to a sewage-farm, which has to deal with immense quantities of sewage, on a small area, or which cannot be easily subdivided, especially if the rainfall is also to be dealt with to any extent. The areas provided by Mr. Bailey Denton, act as filters for the time being, they must be continuously aërated, and the surface frequently broken up so as to allow the filtration to go on. But I prefer an area sufficient for vegetable life to deal with the organic material rather than to turn it into nitrates and nitrites which is the main result of intermittent downward filtration. Every farm should have a portion of its area at the lower part of it capable of being utilized for this purpose, just as every railway must have a break-down gang, should such be required by emergency or accident. It is, however, as an adjunct, not as of first application. For short periods, and at intervals of time, one acre will be enabled to deal with the sewage of 3,000 people on the principles recommended by Mr. Bailey Denton. I agree with Dr. Tidy "in the advantages of intervals of rest alternating with intervals of work," but this is my idea of the work of broad irrigation. In the one case we get the growth of produce which gives wealth for the country, and food for the people, in the other we reduce sewage to its simple elements, and send them away to the sea. The objections which are made against the principle of broad irrigation are such as efficient management, by frequently disturbing the surface of the soil, can always efficiently overcome. Dr. Tidy says, "intermittent downward filtration" had its birthplace in the laboratory; he might have said in the filters of our great water companies. He says also, "no laboratory experiment, pure and simple, can teach sewage treatment." I am again in accord with him, as I am glad to be when I can.

[To be continued.]

The Blue Grotto at Capri. — An item which has been going the rounds recently in regard to the famous blue grotto somewhat misrepresented the intentions of the American gentleman who owns the land above it. The following is supposed to be a correct version of the affair: A lawsuit is in progress concerning the famous Grotta Azzurra at Capri. An American, Mr. John Mackowen, has become the owner of the soil immediately above the grotto. But the village of Capri, in its corporate capacity, has hitherto regarded itself as the owner of the grotto, and as such has levied a small fee from all visitors to the grotto. Mr. Mackowen proposed to sink an underground way from the villa above to the grotto. The village authorities object, both because of their reputed ownership, and because the letting-in of ordinary daylight would put an end to the singular appearance now presented by the place. The American undertakes to construct his passage so that no light from above can penetrate below, and promises to put a gate which shall exclude intruders, as well as daylight. The boatmen who now make an income by conveying passengers to the spot (at present the only mode of getting admission to the grotto) object vigorously to the inroad on their vested interests. It is worth recalling that when the Emperor Tiberius appropriated Capræ for his solitary retreat he had a passage constructed which led down to the grotto, which he used as a bath. This passage is still in existence, but impassible, being choked up with rubbish.— *Exchange.*

THE PROPOSED EIFFEL TOWER.



AN appeal has been addressed to M. Alphand, the Chief Director of Works of the City of Paris, against the colossal iron tower, which is to be erected at the entrance to the Exhibition of 1889. It is signed by many artists and writers, and is to the following effect:

"We come, writers, painters, sculptors, architects, passionate lovers of the hitherto intact beauty of Paris, and protest with all our might and all our indignation in the name of disregarded French taste, and menaced French art and history, against the erection in the very heart of our capital of the useless and monstrous Eiffel tower, which public sarcasm, so often marked by common sense and a spirit of justice, has already christened 'Tower of Babel.' Without falling into the fanaticism of Chauvinism, we have a right to proclaim aloud that Paris is a city without a rival in the world. Above its streets and its widened boulevards, along its admirable quays, amid its splendid promenades, rise the noblest monuments to which human genius has given birth. The soul of France, a creator of masterpieces, gleams amid this august inflorescence of stone. Italy, Germany, Flanders, so justly proud of their artistic heritage, possess nothing which can vie with our own, and from every corner of the universe Paris attracts curiosity and admiration.

"Are we about to let all this be profaned? Is the city of Paris about to associate itself with the grotesque and mercantile imagination of a machine-maker, irreparably to disfigure and dishonor itself? For the Eiffel tower, which even commercial America refuses, is, rest assured, a dishonor to Paris. Everybody feels it, everybody says it, everybody is deeply grieved; and we are only a feeble echo of the universal opinion, so legitimately alarmed.

"Lastly, when foreigners come and visit our Exhibition they will exclaim with astonishment, 'What! is this hideous thing what the French have devised in order to give us an idea of their vaunted taste?' And they will be right in ridiculing us, for the Paris of sublime Gothics, the Paris of Jean Goujon, of Germain Pilon, of Puget, Rude, Barye, and others, will have become the Paris of M. Eiffel. It is enough to consider what we put forward. Imagine for a moment a dizzily ridiculous tower, overlooking Paris like a gigantic black factory chimney, overpowering with its barbarous mass Notre Dame, La Sainte Chapelle, the tower of St. Jacques, the Louvre, the Invalides Dome, and the Arc de Triomphe — all our monuments humiliated, all our architecture dwarfed, and fated to disappear in this stupefying dream. For twenty years we shall see tapering like a spot of ink over the entire city, still thrilling with the genius of so many centuries, the hateful shadow of the hateful column of bolted sheet-iron."

Among the signatories are the following: MM. Meissonier, Robert Fleury, Gérôme, Bonnat, Jean Gigoux, Boulanger, Ch. Garnier, Sardou, Bouguereau, Pailleron, Guillaume, Elle Delaunay, Alexandre Dumas, Coppée, Gounod, Sully-Prudhomme, Jules Lefebvre, Daumette, Français, Thomas, Bertrand, François Lenepveu, Questel, Leconte de Lisle, Lenoir, Henriquel, Goubie, Duez, Maupassant, Jacquet, Courtois, Dagnan Bouveret, Saint-Marceaux, Antonin Mercié, etc.

M. Lockroy, the Minister of Commerce, who has control of the Exhibition, has also addressed M. Alphand, but in a less grave manner than characterizes official utterances in this country, as will be seen from the following:

"From the dignity of the periods, the beauty of the metaphors, the Atticism, and the delicate and precise style, one can guess without even looking at the signatures that the protest is due to the joint labors of the most celebrated writers and poets of our time. This protest is very severe as regards you, M. le Directeur des Travaux, and no less severe as regards me.

"'Paris, throbbing still with the genius of so many centuries,' it says, 'a noble inflorescence of stone, amid which gleams the soul of France, would be dishonored if a tower were erected which trading America refused. . . . This barbarous mass,' it adds, in its lively and highly-colored language, would spoil the 'Paris of sublime Gothics, the Paris of Goujon, Pilon, Barye and Rude.'

"The last passage will strike you doubtless as much as it struck me, for French art and history, to use the words of the protest, had not taught me that Pilon, Barye and Rude were sublime Gothics. But when competent artists state a fact of this kind, all we can do is to bow in acquiescence. If, however, you desire instruction on this point you may obtain it from M. Charles Garnier, whose indignation must have refreshed his memory. I appointed him three weeks ago consulting architect to the Exhibition. Do not allow yourselves to be influenced by the form, which is fine, but look at the facts. The protest is inappropriate. You will point out to those signing it, who will bring it to you, that the construction of the tower was decided upon a year ago, and that the building-yard has been open for a month. The protest should have been made in proper time. This was not done, and this virtuous indignation has the fault of bursting forth too late.

"I am deeply grieved on this account. It is not because I have any fear for Paris. Notre Dame will remain Notre Dame, the Arc de Triomphe will remain the Arc de Triomphe; but I might have been able to save the only part of the great city which was seriously menaced — that incomparable square field of sand called the Champ de Mars, so worthy of inspiring poet and bewitching landscape painter. You may express this regret to these gentlemen. Do not tell them that it is painful to see the Exhibition attacked beforehand by those who should be its defenders; that a protest signed by such illustrious names will make a stir throughout Europe, and will have a chance of furnishing a pretext to certain foreigners for not taking part in our *fêtes;* that they are ill-advised to seek to ridicule a pacific work to which France clings with all the more ardor because at present she is unjustly attacked abroad. Such paltry considerations influence a Minister. They will have no weight with those lofty spirits who are preoccupied above all with the interests of art and the love of the beautiful. What I beg you to do is to receive the protest and to take care of it. It ought to be on view in a case at the Exhibition. Such a beautiful and noble piece of prose, signed by names known throughout the world, could not fail to attract the crowd and perhaps to surprise it."

M. Eiffel has received a visit from a Parisian "interviewer," to whom he discoursed in the following manner:

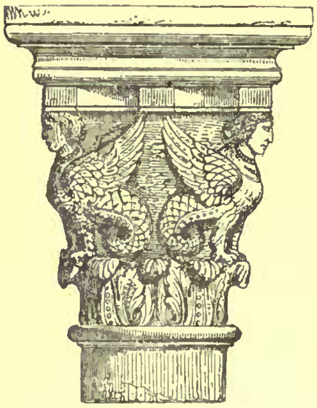
"They begin by declaring," he remarked, referring to his adversaries, "that my tower is not French. It is big enough and clumsy enough for the English or Americans, but it is not our style, they say. We are occupied more with little artistic *bibelots* than giants of bad taste like your tower. But though we are occupied most with art and music, that is no reason," said he, emphatically, "why we should not show the world what we can do in the way of great engineering projects. And as for its being bad taste, why, on the contrary, it will be one of the chief ornaments of the town. One of the most frequent objections made to the tower is that it is useless. That is another error. Take its importance, for instance, from a meteorological point of view. It is not every day that meteorologists can get up a thousand feet above the soil. This tower will enable them to study the decrease of temperature at different heights, to observe the variations of winds, find out the quantity of rain that falls at different heights and the density of the clouds. Indeed, in all that relates to temperature, hygrometry, air-currents, and the composition of the air, the tower will afford opportunities for study and research, many of which have hitherto been impossible. It will be equally useful to astronomers. Here experiments with the spectroscope can be carried on with great facility; the laws of refraction and the physical aspect of the moon, planets, and nebula studied in most favorable conditions. I have received testimonies from *savants* on all these points. Then there is its utility from a military point of view. In the event of another siege of Paris, see how important this tower would be. Communications could be kept up by means of optic telegraphy for a great distance around Paris; for from the summit you have a magnificent panorama extending from 129 to 130 kilometres. Paris by night, decorated and illuminated as it will be during the Exhibition, is a sight which before was only within the reach of aëronauts. In fact, the tower will be the chief attraction of the Exhibition. Sir Cunliffe Owen remarked to me just the other day, 'Do you think that we English will come to look at your little *bibelots* and pots of pomade; no; but we will come in hundreds to see your tower.'

"There is besides an attraction in the colossal, a special charm, to which the ordinary theories of art are not applicable. Will it be maintained that it is by their artistic value that the Pyramids have so much impressed the imagination of men? After all, what are they but artificial hillocks, and yet who sees them and remains unimpressed in their presence? Who has returned from them not filled with an irresistible admiration? And what is the source of that admiration, if it be not found in the immensity of the effort and the grandeur of the result? My tower will be the highest erection ever raised by men. Will it not also be grandest after its fashion? and why should what is admirable in Egypt become hideous and ridiculous in Paris? I seek a reply, and confess I find none."

"What if it topple over, M. Eiffel?" "There is not the least

danger of that. In our construction of the tower we have calculated on the force of the wind. We have calculated that the tower will normally withstand a wind-pressure of 300 kilogrammes per square metre, which amounts to a total pressure of 2,250,000 kilogrammes. We have made this calculation on the most favorable hypothesis possible. We have reckoned the trellis-work as full walls, and made other allowances. And, as the strongest tempests known in Paris have never been beyond a pressure of 150 kilos per square metre, the tower is perfectly secure. Should a wind bearing a force of 300 kilos arise, little would be left standing in Paris except the tower." — *The Architect.*

THE PRESERVATION OF BUILDING STONE.[1]



THE methods for the preservation of stone are, first, properly inclined surfaces that will shed the water so that it cannot stand on the surface; properly undercut mouldings, so that the water cannot creep up under and remain so long as to dissolve out the binding material; keeping out the water as far as practicable. This must be done by water-proofing, so to speak, the foundations; placing a thin layer of asphalt between the foundation stones and the vertical walls of the building proper, two or three feet above the ground. This would prevent the slightly acid waters from the earth rising and decomposing the lower tiers of stones. Asphalting the fronts of the foundation walls themselves, previous to throwing the earth back against them, would prevent the entrance of a considerable amount of water, so that if the face of the foundation next the soil and its top were asphalted, the water would not enter here.

If the stone has been already acted on, and is to be preserved, something must be added to the outside to fill up the pores formed by the solution of the binding material, and prevent further encroachment of the water containing the acid gases in solution. To heat the surface of the stone, already weakened by decay, is only to make the decomposed surface more liable to flake. It must, therefore, be applied to the cold stone. Anything that forms a gum that is impervious to water, and can be made sufficiently liquid to penetrate the pores and pittings of the stone, will answer the purpose. Bees-wax or rosin dissolved in any of their solvents, with or without oil, have been used. Boiled linseed oil, which forms a gum, does very well, and only slightly discolors the stone for a time. But all of these substances decompose after a few years, and must be renewed. Paraffine dissolved in boiled oil, and put on hot, answers better, as it is more effectual, and after one or two applications will fill the pores completely. But no substance applied after decay has begun is equal to a preventive, and no preventive can preserve flat surfaces and projecting mouldings which are not undercut, from decay. Water-glass associated with a bituminous substance, a preparation known as Szerelmy's compound, was used on some of the interior courts of the Houses of Parliament some years ago. I inspected all of these courts in the summer of 1884. The dilapidated condition not only of the finials, but even of the flat surfaces of the stone, showed that it had not even been a palliative.

About the year 1868, the Vielle Montagne Co., of Liege, introduced the process of painting with water-glass and oxide of zinc. This was applied to the railroad station at Liege, and to parts of the Houses of Parliament. A silicate of zinc and lime is thus formed on the outside of the stone, which indurates it superficially. The want of penetration, or careless application of the material, makes the surface flake, and it, like all other paints, requires frequent repetition.

Ransome's process, which consists of using water-glass, with a subsequent application of some chloride, answers very well, but is a very expensive process, as it requires that the stone should be entirely refaced, in order to clean it. This, and the number of applications of the silicate, and subsequent application of the chloride, consumes so much time, and is so expensive, that it cannot come into general use. It has been applied satisfactorily to some small parts of the Houses of Parliament, but has been discontinued on account of its very great cost. The same is true of a number of other processes, which require, first, the cleaning of the stone, and the subsequent application of several chemical substances, such, for instance, as the process of the Silicate Paint Company. They are excellent in themselves; they can be put on with certainty, when used with great care, and over small surfaces; but when they are to be applied to buildings already constructed, they either fail from the impossibility of applying them evenly on large surfaces, or become entirely impracticable on account of the expense. The principle of most of these processes is correct, and it is to be hoped that some corporation will find it to their advantage to have investigations made that will lead to the discovery of some substance which is both cheap and of easy application. Such substances undoubtedly exist, but they require to be sought for. Any process which requires the formation of a chemical union between the stone and the substance applied, must be put on in such a way as both to be certain of its penetration, so that the action will not be superficial, and to insure that the compound formed will not only become sufficiently indurated to withstand the weather, but sufficiently compact not only to resist the penetration of gas, but also to prevent the absorption of moisture, and to shed it at once from its surface. Very few natural stones even do this, and they are the very compact silicious stones, or dense carbonates, which are very homogeneous.

When oils, with or without paraffine and sulphur, are used for waterproofing stone, they should always be applied while hot, as they are then much more liquid, and, consequently, more effectual. It is better, also, that the application should be made when the stone is also warmed by the heat of the sun — that is, either in the spring, summer or fall, rather than in the winter. This application of oil, however, is not permanent in its effects. The oil forms a gum in the pores of the stone, filling them up temporarily, so that the water does not enter, but after a time this decomposes, and must be replaced. It is very easy to distinguish the surfaces of stone that have been treated with oil, by observing them immediately after a shower, when it will be seen that the stone becomes dry much more rapidly than that which has had no such application. The necessity of applying the oil once in every two or three years is one reason why it is so little used. When paint is used, the solid material with the oil is of no account whatever. It remains on the outside, and does not enter the pores of the stone, and when the gum is decomposed it is washed off the surface. Another objection to painting the stone is that, while adding considerably to the expense of the process for protecting the stone, it adds nothing whatever to the efficiency of the oil, and it is very apt to fill up the fine tracery that may be upon the surface of the stone. It is, therefore, entirely unnecessary, and in some cases may be injurious, as preventing the penetration of the material which is designed to waterproof the stone. When oil is heated with an excess of sulphur, it dissolves about thirteen per cent of it. More of it will dissolve in hot oil, but the sulphur crystallizes out upon cooling, and when there is a large excess of it, a partial decomposition takes place, and sulphuretted hydrogen is formed. The oil, with the proper amount of sulphur, becomes thick and dark like molasses, but when heated is quite thin. When the stone is coated with this material, it penetrates below the surface, and as the sulphur is simply in solution, when the gum of the oil decomposes it leaves the sulphur still in the pores. Two or three applications of such a material as this would prevent any further decomposition. It has been found by experiments made on the Houses of Parliament that sulphur applied in some such way has been the only thing that has arrested decomposition in that soft, porous stone; but even this preparation has not prevented the flaking of the surface of the stone after an exposure of about twenty years, probably because it was not applied hot, and was put on when the stone was moist, or when the weather was cold.

If twenty per cent of paraffine be added to oil containing the sulphur in solution, it thickens when cold into a semi-solid buttery mass, but is fluid when hot. Such a preparation as this, applied hot to the stone, gives another element with the sulphur, which does not decompose, to fill the pores of the stone. There may be cases in which it is undesirable and inconvenient to use sulphur, and in these cases twenty per cent of paraffine mixed with hot oil may be used. The same is true of this as of the other preparations mentioned. The paraffine, which is, like the sulphur, practically indestructible, remains in the pores of the stone after the decomposition of the organic matter of the oil has taken place, and one or two coatings of such material as this will waterproof the stone entirely and prevent further disintegration. Other preparations of paraffine may be used to advantage, but those which involve heating the surface of the stone should be avoided. It has been suggested that these preparations discolor the stone. It is true that the color of the stone is darkened by them, but the stone is not disfigured, as the color given is very nearly uniform over the whole surface. In some cases the stones, after the application of the oil, have been washed with ammonia salts to take off the excess of the material from the surface. It is generally, however, undesirable to do anything to the stone after the liquid has been applied, as the surface will very soon become bleached by the action of the weather.

It has been objected to the use of oils that they would interfere with the adhesion of the mortar in the stone, if the stone were treated before it was put into the building. In actual practice, however, this does not seem to be the case. The stone is not only more thoroughly protected from moisture upon all sides — for in stone buildings in damp countries the moisture is as much to be feared on the inside as on the outside — but it does not seem in any way to deleteriously affect the binding power of the mortar. It acts advantageously both on the stone and the mortar, and does not influence any of the chemical changes that take place, either by accelerating, retarding or preventing them. This fact was well known to the ancients, for they used oil in mortars and cements to a considerable extent. When it is desirable to use soft and very porous stones for building purposes, the stone should be dipped either into boiling oil or some such preparation as this, before being put into the building, so that its entire surface may be coated. The experience of the last thirty years shows that the stone cannot be perfectly protected unless this is done on all sides of the stone. Such coating does not in any

[1] Extract from a paper by Thomas Egleston, Ph. D., read before the American Society of Civil Engineers, and published in the *Transactions* of the Society.

way prevent the adhesion of the mortar, if done either before or after it is put into the building.

In the experiments made in the year 1861, I was successful in preventing the further decay of a building which has, up to this time, shown no sign of lamination or disintegration. This was done by the use of thoroughly boiled oil alone, applied with a brush during the warmest of our summer weather, when the stone was very hot. It was done twice, at intervals of several years, and completely arrested the decay for the time being. It would have been much more effectual if the preparations mentioned above had been used. The application of such material does not change the surface of the stone. It was used almost exclusively on porous sandstones. It seems to form a sort of cement, similar to the organic binding material which is so common in many of the brown sandstones, but with the limestones this has not been found useful to any extent. It requires renewal so often, and changes the color of the stone so unpleasantly, that it has not been found of service with these stones. Such preparations are, however, of no use on stones of whatever character, where the decay has been produced by disintegration caused by the unequal expansion and contraction of the minerals forming the stone. Such disintegration is very slow in most stones. It has taken thousands of years to produce it in the granites of the obelisks of hot countries. It appears to be more rapid in cold ones, but it takes place with unerring certainty and regularity in all those rocks where the minerals composing them have different rates of expansion and contraction. Here, as in the other case, there are cavities, but the filling of them does not arrest the decay, because it does not attack the cause. Nothing will arrest such decay, and no other decay in stone, except those caused by the air and water, can be prevented by any application to its outside. It is therefore useless to attempt the preservation of such rocks as granite, since the unequal expansion of the minerals which compose the rock cannot be arrested by filling the cracks. They are applicable only to stones from which something has been dissolved out, leaving cavities which can be filled from the outside. Waterproofing the surface of a stone has the effect of keeping the water out of pores that allow some of the constituents of the stone to be attacked, and is effectual in those stones only which are either porous by nature, or have become so by the solution of parts of their ingredients; but it has absolutely no effect where there is any movement in the particles which compose the stone, however this movement may be produced.

No method of protecting the surface of the stone of the Houses of Parliament has, so far, been successful, except where sulphur was dissolved and added to the outside of the stone, and this rendered the stone for a very long time waterproof. It had remained so for twenty years up to August, 1884, when I examined it and found that it had begun to laminate, the part of the stone containing the sulphur peeling off in thin scales. The experience of the repairs at the House of Commons is that most of the substances which are supposed to be useful are absolutely useless, if not positively harmful to that stone; that almost the only one that has been successful at all on these stones has been sulphur dissolved in some compound, and applied to the stone so that the sulphur itself was precipitated in its pores. But even this does not seem to have entered very far, and has not been successful unless the stones put in place of those removed had been treated on all their six sides. In that case the stone has been preserved, but how long it will remain so it is impossible to tell.

With dolomite, in which there is a large excess of lime, the only safety is to prevent the action of the carbonic acid contained in the air by waterproofing the outside of the stone. This can be less successfully accomplished, because, as the surfaces of attack are comparatively large, the action is from the outside, and but little pitting takes place, as the interlacing of the crystals makes cavities that never can penetrate far into the stone. Any coating applied to the outside will therefore be likely to wear off after a time, and thus leave fresh surfaces of attack, which do not at once become visible, as the surface is constantly kept clean by the rain and the wind.

All the experiments made in Europe with the use of silicate of soda, or water-glass, upon any building stones, except those in which lime and magnesia were principal elements, have met with signal failure. The use of water-glass or siliceous material amounts to nothing on siliceous rocks. The silica becomes decomposed by exposure to the air, and forms a sand which drops off, and the caustic alkali is washed out or remains behind to help the disintegration. The only things which have been successful have been those that prevented the attack of the acid gases or water from the surface or sides of the stone.

Waterproofing is best done by a compound of paraffine, sulphur and oil, applied to the stones before they are put into the building, or else frequently applied to the surface after they are put in. In sandstones the sulphur is not necessary. Oil, with a certain amount of paraffine, may be used, providing the application is made hot. If, however, it is made cold, the preserving material sinks but a little way into the stone. If the stone is heated from the outside, with the intent to bring the surface of the stone up to such a point that it will heat the paraffine, there is great danger that the stone will suffer more from the remedy than from the disease.

There is no necessity for the decomposition of brownstone, if the material is carefully selected. Every building that I have examined contains some stones that would last indefinitely, and if only those were selected from the quarry which have a silicious cement, there would be no necessity for waterproofing, and we should not have the rapid destruction in beautiful structures which is so common in countries where sandstones are used. The same kind of external waterproofing must also be done upon dolomite and limestone, but efforts in this direction have been less successful than upon sandstones. Many methods for the prevention of disintegration have been tried, not only with no success, but with absolute failure.

THE BUILDING EMPLOYERS' PROTECTIVE FEDERATION, NEW YORK.

SOCIETIES

A MEETING of employers in the various branches of the building trades was called for 2 o'clock on Monday, the 14th, at Masonic Hall, Twenty-third Street and Sixth Avenue, at which the building trades were well represented; notwithstanding the unseasonable or inconvenient hour, a large and enthusiastic gathering took place. Mr. Charles Buck, Chairman, at previous meetings, could not be present on account of sickness. Mr. Thomas Cochrane was called to the Chair, and Mr. H. H. Hill acted as Secretary. The name of the organization (which is "The Building Employers' Protective Federation,") together with the Constitution and By-Laws forming the permanent organization were adopted, and with a membership of nearly five hundred. The election of officers for the ensuing year was then proceeded with, when the following gentlemen were elected.

George Hayes, President; Thomas Cochrane, First, and William Hoane, Second Vice Presidents; Hugh Lamb, Treasurer; and H. H. Hill, Secretary, and the following Trustees, viz., W. P. Chesley, Walter Reed, G. H. Kitchen, Enoch Kuetzler, David Morrison, John D. Ottiwell, Jos. A. McDonnell, H. Mandeville, Charles Buck, and A. J. Campbell.

In this Association one of the objects sought will be to fairly consider the rights of the employed, as well as the employer, and will tend to relieve the well-thinking mechanic of the tyranny to which he has been subjected, by being under the control of abusive societies. Cool deliberation will take the place of hot-headedness, which has hitherto prevailed, and the employer and employed will both be benefited.

After considerable business was transacted, the meeting adjourned to 8 o'clock, P. M., on Monday, the 21st, at Painter's Hall, 3 North Washington Square.

COMMUNICATIONS

OPENINGS FOR CONTRACTORS.

TORONTO, March 10, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Would you, or any of your numerous readers, kindly tell me through your columns what localities in the United States of America or Canada present the best advantages for progress to a sanitary and water-works engineering contractor, of large and capable English practice, and what steps would be most advisable to pursue in the establishment of such a business in the country. Any hints on these or other lines would be thoroughly appreciated by

"AXIS."

[If we may judge by the number and magnitude of engineering works now in progress, the Southwestern States offer a good field.— EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

STRIKES AND LOCKOUTS. — In January, 1887, there have been reported 92 strikes and lockouts, involving over 73,300 employés, as compared with 19 strikes and 47,200 employés during January, 1886. Of the former, 88 strikes, involving 63,300 employés, were concluded by February 28, while 4 strikes, including 10,000 men, were still open. Of the 10,000 about 8,000 are New England boot and shoe factory hands, locked out as a protest against the Knights of Labor dictation as to shop management. The number of shoe operatives locked out or on strike February 1, 1887, was approximately 8,400; on March 1, 1887, 5,900. The number out in various small strikes is about 900, as about 400 February 1. In the great lockout in Worcester county there has been a gain, though not closely definable, by reason of new help hired and old hands returning on the employers' terms to some extent. It is estimated that the total out February 1 was 8,000, and March 1, 5,000. The first may be too large, the second too small. The total number of successful strikes of the January list, including compromises or successes, was 31 out of 88, ended by March 1, involving 18,173 employés. As the January strikes of 63,300 employés are ended, this shows that about 30 per cent of the employés have thus far been successful. The prospect, however, is for a smaller percentage of success after the termination of the boot-and-shoe lockout. The totals of failures are 57 strikes and 45,127 employés; about 70 per cent. In January, 1886, 9 strikes, with 23,000 strikers, were successful — nearly one-half — while ten strikes, with 23,300 strikers, were failures. In February, 1887, there were 74

strikes and 26,000 strikers, as compared with but 5 strikes and 10,700 strikers in February, 1886. By the close of the month 51 strikes, involving 20,000 strikers, had ended, and 23 strikes, with 6,000 strikers, remained unsettled. Of the 51 strikes, with 20,000 strikers, 12 strikes, with 5,350 strikers, had been successful, a little over 20 per cent; while 39 strikes, with 14,650 strikers, nearly eighty per cent, had been failures. In February, 1886, all the strikes were failures. Tabulating the totals for the past two months as compared with like figures for 1886, the following exhibit is obtained:

	No. of strikes.		No. of strikers.	
	1887.	1886.	1887.	1886.
Totals	166	24	99,300	57,900
Total ended March 1	139	24	83,300	57,900
Total not ended	27	..	10,000	....
Total successful	43	9	23,523	23,300
Total failed	96	10	59,777	34,600

A feature of the strikes thus far during 1887 has been found in the increase of "sympathetic" strikes — the stopping from work of employés of others than those parties to the dispute in order to force concessions from the parties really in interest by disorganizing productive and distributing agencies. As may be seen from the list of strikes given herewith, no fewer than 41,000 employés struck in sympathy with the 4,000 New Jersey coal-handlers and Old Dominion Steamship Company 'longshoremen, although in nowise personally interested in those disputes. It is also worthy of note that nearly 35,000 industrial employés have been thrown out of work within the two months, through inability to secure coal or supplies of raw material on account of strikes of others.— *Bradstreet.*

THE MANAGEMENT AND CARE OF WIRE HOISTING-CABLES. — The *Compagnie des Forges de Châtillon* has been publishing a valuable and interesting set of rules and tables for the using of wires and metallic cables. Regarding the use and care of hoisting-cables, the company says: If the conditions do not permit the employment of hoisting-drums of 16 to 20 feet diameter, the cables should be of steel of great resistence, and have a safety-factor of 10; with cables of charcoal-iron, or soft steel, a factor of 6 can be used, especially if workmen are not to be lowered by it. Every two or three months the drum-fastenings should be renewed, and cables should be cut long enough to change this loading-point considerably. The tensile strength of the wires in the end should be tested each time the fastenings are shifted, and careful attention paid to broken wires at these points. This being the most abused portion of the cable, if the sum of the resistence of the sound wires exceeds one-fifth of the breaking-strain, the cable is still fairly safe; the broken wires in any one metre of cable-length are rejected in such an estimate of strength. Every eight days, and whenever the cable is cleaned the broken wires and frequency of breaks should be noted. When the number of broken wires in a running metre of cable reach one-tenth of the total wires, workmen should not trust themselves to it, but the cable may be used for hoisting material. Every eight days the cable ought to be carefully cleaned, then greased. For the latter purpose the coating should have, in summer, the consistency of butter, and be made of vegetable tar and tallow in equal parts. When this mixture is too stiff a little oil will soften it. Other lubricants can be used, such as heavy oils with tallow; tar and oil and heavy oils with oil of rape-seed (colza). The first-named mixture is the best, however. If the cable is much exposed to water, this greasing is required more frequently. There should be not more than two-tenths-inch play between the cable in its thickest part and the confining rims of the sheave or drum. In the form of general but important recommendations these rules warn the user to avoid the lashing or violent lateral movement of cables; quick jerks in starting to hoist, do not let the guides bind; avoid friction of the cable on any object other than the drum; give the drum 20 feet diameter if possible; examine the cable carefully after any accidental shock or abnormal "side-lash," and look well to the proper condition of the axles of drums and sheaves and their bearings.

To calculate the section of hoisting-cables to adapt them to a given load, and allowing for a given weight, the following rule is given by the *Compagnie des Forges de Châtillon:* Let P be the weight to be raised; L the length of the cable; R the resistance to rupture in "kilogrammes per square millimetre," and $\frac{1}{m}$ the coefficient of safety adopted, which may be taken at one-sixth, but is sometimes taken at one-tenth. Then if we adopt a cable of useful section S, and useful weight per metre p, we have $p = S\,0.0085$. But as the cable should also carry its own weight, we have $\frac{RS}{m} = P + L\,p$; whence $\frac{RS}{m} = P + L\,S\,0.0085$; whence $p = 0.0085\,S = 0.0085\,\frac{Pm}{R - L\,m\,0.0085}$. — *Engineering News.*

PROTOTYPES OF M. EIFFEL'S TOWER. — The Eiffel Tower might be cited in common with the majority of novelties as a proof that there is nothing new under the sun. It is well known that Trevethick, the Cornish engineer, did propose to erect a structure of the kind as the best memorial of the Reform Act of 1830. But it is also true that in 1845 a M. Cabillet prepared designs for a tower in Paris, which he called "La Tour de 1,000 pieds." It was to be conical in form, to be accessible to the top by means of a lift, and to have glazed galleries at different stages in which the spectators could contemplate the world at their ease. He calculated that four or five hundred people could ascend every hour, the time occupied being from five to twelve minutes. M. Cabillet, like M. Eiffel, did not propose that his tower was to be monopolized by sightseers. He also spoke about the opportunities that would be afforded for meteorological observations, and the advantage of being able to communicate with distant observatories. In those days the Parisians considered that nobody but a provincial would run the risk of vertigo by mounting to the top of the Colonne Vendôme or the Arc de Triomphe, and in consequence M. Cabillet's scheme was relegated to oblivion. It is dragged forth as a curiosity for a moment, and when it returns a good many will wish that its rival could also bear it company. — *The Architect.*

STONE STAIRS. — It is not very uncommon to see solid stone stairs, with open well-hole and exposed soffit, put up with each step merely lapped over the other and pinned into the wall at one end. Architects well know that this is seldom enough for such stairs, but that, to be safe, each step must be notched upon the one below it, and that they often fail when otherwise executed. It is all-important with stairs of this kind that the bottom step stand on a thoroughly firm foundation, and that the lower front edge and the upper back edge of each step be well notched, the one to the other; the best form of notch, when the steps are triangular, being that with which you are all familiar, but for rectangles a square notch is preferable. Stairs are very strong when thus properly notched, but many faulty stairs exist even in good buildings from insufficient attention to the point. I suppose that what I state should be vouched for by an instance: therefore, let me name the railway station at Sydenham, where the stone steps were not notched, and where they got out of place, but, being observed in time, a queer remedy was applied by putting timber-beams under them, and wood strings housed on with wood rail and balusters, instead of the former of iron, and to the lower portion a wall was built under the ends. The stairs of the Shire Hall, Chelmsford, fell in 1856, breaking off, and leaving the ends in the wall. The accident was attributed to the landing falling first, yet this could scarcely have occurred if proper construction had been attended to. It is quite as necessary for the landing as for the steps to be notched on, and the landings should be joggled together, and in many cases it is wise to put an iron beam, but never a wooden one, on account of its shrinkage, which, however slight, would slack the bearing.— *E. Nash.*

TRADE SURVEYS

AT the present rate of expansion in manufacturing, railroad-building, house-building and machinery-making, it seems to be only a question of time, judging at least by our past history, when over-production will call a halt. The country is not producing more than it needs, but may be producing and expanding faster than a symmetrical development permits or requires. Consumptive capacity ought to be doubled and expand year by year beyond. The people are not too sumptuously fed or clothed or housed, and until they are there can be no legitimate over-production. That which concerns this practical age is how to regulate production to the slowly-expanding consumptive capacity. A stop or a checking-up must be brought about in a short time. Our economic and social affairs do not admit of a go-as-you-please expansion. It seems to be beyond the reach of the intelligence of the age to provide markets for our energies, or rather, the results of energy. Such an equilibrium will some day be found, but it is too remote to be studiously regarded now. The world is crowding its energies; shops, mills, mines, factories, have no idle capacity. The work of colonization is going forward, and will be greatly increased. The unauthenticated rumor that a syndicate of American and British capitalists contemplate the investment of twenty million dollars in South American railroad enterprise only points to what must and will take place. The age of enforced compactness of industrial and agricultural communities is going. A disintegration is going on, made possible by cheap and easy travel in and to all parts of the world. Evils hoary with age will rust rapidly away under this coming scattering of the world's population. The home industrial conditions are sound. Less business was transacted last week because of the uncertainty as to what freight-rates will be after April 5. No weakening of prices is observable, and buyers in all channels of trade will continue to cover future requirements as they have been doing. The railroad-barometer shows improving demand and higher mid-summer prices. Labor has been quietly advanced in many branches. Material has increased in cost. Certain kinds of lumber are higher by one dollar per thousand, and demand is only awaiting the actual opening of the spring trade. The Western supplies are fully up to every probable requirement, and the yellow-pine markets are full. Hardwoods are scarce. Hemlock is held under something like a speculative control. White-pine is strong in price and in primary markets. Heavy shipments are being made to both Eastern and Western markets at cut rates, in order to discount the new rates under the inter-State commerce law that will go into effect about April 1. In view of the immense stocks of lumber in manufacturers' hands, any attempt on their part to maintain high prices will check the spring trade and cause a collapse. Lumber is being rushed out of far Northwestern markets as rapidly as shipping faculties permit. The moderate improvement in building-operations, so far this month, in the West and Northwest, is easily explainable. Questions of wages and cost of material have arisen in some quarters. It has been a question whether the rank and file of labor organizations would revolt against the conservative management and advice of the leaders who have been warned against an extreme course. The building-operations in the West will be characterized this year by the large number of small houses that will be erected. A great deal of lumber has been contracted for to prosecute building enterprises along the lines of roads leading out of the principal Western cities. The lumber demand in Eastern cities and towns will, of course, exceed last year, and Western manufacturers are establishing Eastern agencies in order to profit by direct dealing. Higher freight-rates, higher sawing and dearer labor, coupled with a more active demand, all promise to make the lumber problem quite an interesting one. The coal-trade is unsettled for like causes. Wages have been advanced among bituminous miners. The three railroad corporations which handle the bulk of the coal consumed in the East, held several conferences this week and fixed freight-rates and tolls under the new law. Anthracite has advanced one dollar as against last year, and soft coal fifty cents. Taking a passing glance at the iron industry we find production one hundred and thirty-five thousand tons of crude iron per week. Bar iron has advanced two dollars per ton. Rails, two dollars per ton. Steel rails are weaker. Old rails irregular. Large iron and steel imports are due shortly. The American iron trade is calling for ore from Cuba, Spain and Africa, crude steel from Germany, and steel rails and tin plate from Wales. The deficit this year to be supplied from foreign sources will be fully thirty per cent, possibly fifty per cent over last year. In the lighter industries orders continue to crowd capacity. In real-estate operations no weakness is manifest, especially in city real estate. Large transactions are reported from week to week in suburban properties for building purposes. In New York, Pennsylvania, and Ohio especially is real estate active, largely estimated by industrial activity. Fortunately, breadstuffs and provisions, as well as rents, will rule lower, and thus add to the general contentment and confidence.



HELIOTYPE PRINTING CO., BOSTON

FIRST METHODIST EPISCOPAL CHURCH, BALTIMORE, MD.

McKIM, MEAD & WHITE, Architects.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, by TICKNOR & COMPANY, Boston, Mass. No. 587.

MARCH 26, 1887.

Entered at the Post-Office at Boston as second-class matter.

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THE project for enlarging the Massachusetts State-House at the smallest possible expense is still agitating the minds of various clever persons in Boston. One of the most prominent members of the City Government, with a painstaking zeal for the interest of the city which is at least worthy the admiration of the tax-payers, has devised a plan by which the city can present to the State a large vacant lot, for which it has now no use, on the understanding that the State will contribute the money for securing a considerable additional amount of land, which, with the city's lot, will provide space enough for almost any desirable enlargement of the capitol building. We do not pretend to know enough about the subject to say whether Mr. Whitmore's plan is a good one or not, although it seems to be extremely well-considered and practical. According to the newspaper reports, his scheme contains, however, one amusing suggestion, to the effect that owners of estates adjoining the property of the State should be forbidden by law to erect structures on their land calculated to dwarf the State-House. This method of maintaining the dignity of a diminutive building with august associations strikes us as worth remembering, not only for its novelty, but the extent of the applications which can be made of it. Just what are the dimensions which a Boston mansion cannot exceed without "dwarfing the State-House" it would be interesting to know; and if the proprietors of lots in the neighborhood can be prohibited from erecting structures of more than the dimensions which the collective wisdom of the lawyers and legislators of the Commonwealth decide to be without dwarfing effect on that cherished memorial of the past, we do not see why they cannot, with considerable advantage to the effect of the State-House, and an immense saving of counsel fees, be compelled to pull down at once all the buildings on their land, and leave it bare, consoling themselves for their loss of rent by contemplating the proportions of the sacred structure, made doubly majestic by being illuminated with what Mr. Ruskin would call the Lamp of Sacrifice. We are not without apprehension that the adjoining proprietors may not accede readily to this arrangement. There is no doubt that the people who do not own lots on Beacon Hill, and who constitute a large majority of the population of the State, would see very clearly the fitness and necessity of this slight submission on the part of the minority to the wishes of their brethren, but if the minority proved contumacious, there might be difficulties, which we dislike to contemplate, in reducing them to obedience, and we doubt if even the beauty of the Massachusetts State-House is worth preserving at the expense of the rights of citizens. That the people of the Bay State should be fond and proud of their Capitol we can understand well enough, and no one would be better pleased than ourselves to see it cherished and guarded by all possible evidences of care and regard; but its dignity cannot be enhanced by assaults upon the property of its neighbors, or by compulsory humiliation inflicted upon estates near by. We are told in proverbs of a land where a cat might look at a king. The Bostonians have a wise and good king, it is true, but small and antiquated in figure and complexion, and, as it seems to us, some of them have an idea that by admitting only very small cats to view their sovereign, they can spread, in the outside world, the idea that he is of colossal size and perennial youthfulness.

A NEW and rather startling symptom of the increase of public sentiment in favor of requiring certain guaranties of capacity from those who undertake to do work upon the proper execution of which the public safety may depend, is to be found in the introduction of a bill in the New York Legislature, providing that the mayor of each city in the State shall, within thirty days after the passage of the act, appoint a commission of five experienced persons, who shall determine the competency of every person who may desire to secure a license as a mason builder. We suppose that, as a corollary to this provision, no one is to be allowed to practise the art of masonry, in cities provided with commissioners, who cannot show a proper license; and it is specified that one of the privileges of the commission shall be to revoke licenses on occasion. The bill is introduced by Senator Griswold, on the recommendation of the New York State Convention of Master-Builders, which sat at Albany last month. We should say that it had not much chance of becoming a law, simply from the absence of the organized and energetic advocacy which is usually needed to carry out legislation having no political or popular interest, and which the mere recollection of the desire of a past convention is very far from resembling; but on many accounts the proposed statute would be an excellent one. Two centuries ago, when nearly every one lived in a little wooden house, two stories high, at most, in the framing and raising of which the whole neighborhood participated, no one thought of requiring a certificate of competency from those who erected it, to make sure that it was so built that it would not fall down on the owner's head, although we have seen cases where this might have been done with advantage. Now, however, people live and do their work in buildings four, five, six or eight stories high, constructed of brick, pierced, balanced, tied and cemented in ways about which the untechnical citizen knows nothing except that if the balancing, tying or cementing is improperly done, the structure will probably sooner or later come down, and that those who happen to be in it will suffer. Careless people comfort themselves by thinking that the chances are against their being in the building at the time of the crash, but the thought occasionally comes to the prudent ones that it would be an excellent thing to be sure of the reasonable solidity of the edifices in which they trust themselves. For those engaged in other employments to know anything of value in regard to the modern art of construction is difficult, and to judge with certainty in regard to works of construction is for them practically impossible; and they feel, as they do when submitting themselves to a doctor's or a plumber's treatment, that they would be very glad to have the protection against malpractice in building which the law affords them against malpractice in the two other arts. The licensing of architects would be one step in this direction, and it seems not unlikely that this step will soon be taken. The licensing of builders would be a fitting, and almost a necessary supplement to that of architects, but it would be opposed, directly and indirectly, by such a host of Buddensieks, capitalists and others interested in the worst, cheapest and most ignorant sort of building that can be made to stand up until a tenant or a purchaser comes along, that it is nearly hopeless to expect such legislation in this generation.

THERE is little doubt that the Bussey Bridge was badly designed, and that it contained structural defects, which, even if they did not actually cause the recent accident, sooner or later, under what seems to have been the not too careful inspection of the railroad officials would have brought about the fall of the bridge, and there seems, too, to be evidence that the rolling-stock was not what a wealthy railroad should use even in "working-men's trains." For these shortcomings there is a legal responsibility against the proper enforcement of which we have no desire to raise our voice. We do, however, mean to make a protest against the course pursued by the pharisees of the press who lay so much stress on the *moral* responsibility of the owners of property which occasions loss of life. In the

abstract there should be, of course, a moral accountability for all disasters; but the owner who will build a combustible structure, the merchant who will allow smoking in his warehouse, the parent who will send to school a child from a home where a contagious disease is raging, the legislators who fail to enact perfect laws, the editors who seek to regulate all human affairs, and force them to take the shapes and limits of their own imperfect knowledge, are not the ones to take up the rôle of avenging angels. There are accidents which, humanly speaking, are inevitable: they must happen, not because they could not have been prevented, but because the millennium has not yet arrived. Railroads are peculiarly liable to this class of mishaps, and the wonder is not that they do happen, but that they do not happen oftener. If we moderns will insist on travelling over the face of the earth at forty or fifty miles an hour, knowing as we do how slight a defect will cause disaster, we believe that each of us voluntarily assumes a moral responsibility as great as that of the railroad, and that there would be abstract justice in a law that should make the purchase of a railroad ticket a release to the railroad from all claim for indemnity in case of injury. If a passenger wishes to secure himself, he can take out an accident-insurance policy, and if the public wishes to protect itself, so far as possible, it can create a governmental body with power to compel every railroad to keep its road-bed and rolling-stock in really safe condition, or else cease to act as common carriers. A railroad, one of whose trains could legally run at fifty miles per hour, while the next one could not exceed a rate of five miles without subjecting the road to heavy fine, would soon find money to buy improved rolling-stock for the second train, and so with roads and bridges. The Boston & Providence Railroad will probably have to pay heavy damages, but we hope these will be assessed fairly, and not in a spirit of revenge.

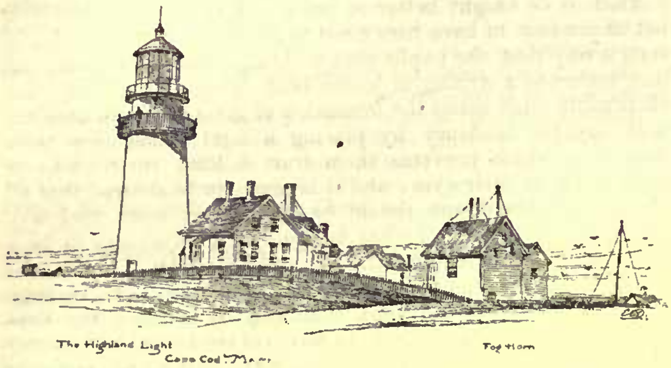
DR. LINCOLN, of Boston, the well-known writer on school hygiene, has written recently for the *Sanitary News* some suggestive papers on his favorite topics, many points in which merit the attention of architects. His most interesting paper in this respect is perhaps that on the hygiene of the eye, a subject, the importance of which may be appreciated by reflecting that in Germany, whose schools are models for the imitation of the civilized world, sixty-two per cent of all the pupils in the advanced schools have become permanently near-sighted, to the serious detriment of the usefulness and comfort of the rest of their lives. In New York, out of nearly three thousand children examined by Drs. Derby and Loring, twenty-seven per cent of those just completing their school-life were found to be near-sighted. According to Dr. Loring, although the greater part of the trouble is with German children due to the severity of the study which their schools demand, something is also to be laid to the account of the unwholesome mode of living, and neglect of out-door exercise common in Germany; but it should not be forgotten that if the habits of life of the Germans are bad in comparison with ours, which we are not quite ready to admit, they far surpass us in the systematic physical training which they unite to mental discipline, and, although young New York children may possibly be more active, and fonder of out-door play, than their German contemporaries, the latter generally gain as they grow up in firmness of muscle, erectness of carriage, and power of digestion, while the New Yorkers deteriorate in these points, until the first scholar of his class in an American college, thin, stooping and nervous, although he may not wear spectacles, appears to very little advantage beside the manly, comfortable figure of a German Doctor of Philosophy.

THE Germans are quite aware of the sacrifice in one point of physical perfection by which they now secure mental development, and are hard at work upon the problem of making it possible for children to study long and intently, day after day, without changing the focal length of their eyes. They have already done much toward its solution, and other people will, it is to be hoped, follow them closely, until myopia, like other diseases due to avoidable causes, has become a tradition of the past. How great is the need of controlling school-children in such a way as to prevent the acquirement of habits by which the eyes are permanently affected, may be judged from an observation made by Dr. Lincoln himself, who says that he once saw a whole room-full of children writing, with their eyes at an average distance from their paper of less than three inches. An hour of work in such a position would do irreparable injury to most person's eyes, and a teacher who would permit children to endanger their sight in this way ought himself to be taught better at once. In German schools it is not uncommon to have bars fixed to the front of their desks, in such a way that the pupils cannot bring their eyes within fifteen inches of a writing or lesson book lying on the desk; and all oculists often assist the formation of good habits in children with myopic tendency by placing a light frame over their shoulders, which prevents them from holding their books or work too near their eyes; and it is much to be desired that all persons of school age should be guarded in some such way from the acquisition of what is agreed by physicians to be a needless and abnormal habit. According to Dr. Lincoln, the weak or dim vision which frequently leads to myopia, through the effort made to see more distinctly by bringing the eyes nearer the object, may be due to physical weakness, such as that which follows recovery from a fever, or the natural relaxation of the vital forces in early morning, before breakfast has supplied the body with means of resistance to adverse influences; or to congestion in the head, caused by collars or clothes too tight around the neck, or to a stooping or reclining position, which disposes the blood to flow more freely than usual to the head; or to imperfect light, including both the deficiency of illumination which renders it difficult to distinguish the shape of the letters, and the dazzling, due to sunlight on the page, or the contrast of a blackboard beside a window, which causes dimness by confusing the impression on the retina. To avoid with success the disease to which these causes lead, the school-room or study should be lighted according to the rules which every architect knows; and care should be taken never to allow children to read while lying down, or with the sun shining on their book or desk. The paper or page should be maintained at a distance of about fifteen, or, as some authorities say, at sixteen inches from the eye, and rest should be frequently taken by looking away from the book. Dr. Lincoln makes the excellent suggestion that charts in large type might with advantage be used in teaching classes, both as avoiding the necessity for a certain amount of poring over books, and, we might add, to rest the eyes by allowing them to return for a time to the ordinary focal length; and we are disposed to think that the use of such charts, assisted, perhaps, by the drawing of maps or sketches, or even writing, from large copies placed at a distance, might be made of very great assistance in promoting good habits among children inclined to myopia, and even in restoring eyes which had become somewhat affected. We have ourselves often noticed that an hour or so spent in trying to make out distant objects at sea, or from the top of a hill, would result in a change of the focal length of the eyes which was noticeable for a day or two afterward in the increase of the distance at which a book could be read with comfort; and the alternation of the muscular action of the eye from that necessary to lengthen it, to accommodate its focus to rays proceeding from an object fifteen inches away, to the flattening required to accommodate it to rays from one at a long distance, is, as every sketcher knows, a pleasant relief, which might, if systematically followed, do much to keep young and impressible eyes in good condition; while the effort, for children already slightly near-sighted, to see the distant charts, might, if the strain were prevented from being too severe by giving them favored positions, assist materially in their cure.

THE *Technologiste* describes a simple method of treating wood with preservative solutions, which is applied in Norway to telegraph-poles. After the poles are set in place, a man goes from one to another with an auger, with which he bores a hole in each post, beginning at a point about two feet above the ground, and boring obliquely downwards, at as small an angle as possible, with the axis of the post, until the point of the auger reaches the centre of the stick. The auger-hole should be an inch in diameter, and, in telegraph-poles of the ordinary size, will hold easily four or five ounces of sulphate of copper, which is put into it in the form of coarsely powdered crystals, and the opening then stopped with a plug, the end of which is left projecting as a handle, so that it can be pulled out and replaced. Just what action it may be that then goes on in the interior of the stick, no one pretends to say; but it is found that the crystals of copper sulphate disappear slowly, so that every three or four months the charge must be renewed; while the wood, both above and below the auger-hole, even to the very top of the pole, gradually assumes the greenish tint due to the presence of copper in the pores.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — X.

SPECTACLE REEF LIGHT-HOUSE.



THERE is but one other light-house in the United States of the same type as Minot's. This one is situated on Spectacle Reef, Lake Huron, and is not properly a *sea*-rock light-house, as the destructive agencies to which it is exposed are not sea-waves, but chiefly ice-packs.

It stands on a reef at the northern end of Lake Huron, off the eastern end of the Straits of Mackinac. There are two shoals of limestone rock *in situ*, covered with boulders so situated with respect to each other as to resemble a pair of spectacles. The light-house stands on the southerly end of the most northerly shoal.

In 1868 the Light-house Board recommended an appropriation to erect this light, estimating the cost to be about $300,000. The wreck of two vessels at one time, the preceding fall, gave emphasis to its necessity, as these wrecks involved the loss of a sum greater than that necessary to mark this danger. An appropriation of $100,000 was granted to commence the work, and next year an additional sum of $100,000 was appropriated.

An examination of the site showed that the least depth of water on the shoals was about seven feet, and at the locality selected for the light-house, rock was found at a depth of eleven feet.

The nearest land is Bois Blanc Island, about eleven miles distant. A depot for this work was established at Scammon's Harbor, in Les Cheneaux, sixteen miles from the site.

The greatest exposure to waves is from the southeast, the sea having a fetch of about one hundred and seventy miles. Their force, however, is not so great as to require any great precautions to insure stability. But at times currents are developed here having a velocity of from two to three miles per hour, and during the winter season serve to move to and fro ice-fields two feet thick and thousands of acres in extent. This ice, formed in fresh water, is of extreme solidity, and when in motion has a living force which is almost irresistible. The object was, therefore, to oppose to it a structure against which the ice would first be crushed, and then its motion so impeded as to cause it to ground upon the shoal itself, thus forming a barrier against subsequent action.

To give some idea of the necessity for this, it may be mentioned that in the spring of 1875, when the keepers returned to the station, the light being discontinued during the winter months, they found the ice piled up against the light-house, seven feet above the sill of the door-way, which is twenty-three feet above the lake, and they were only able to obtain entrance to the house by cutting their way through the ice.

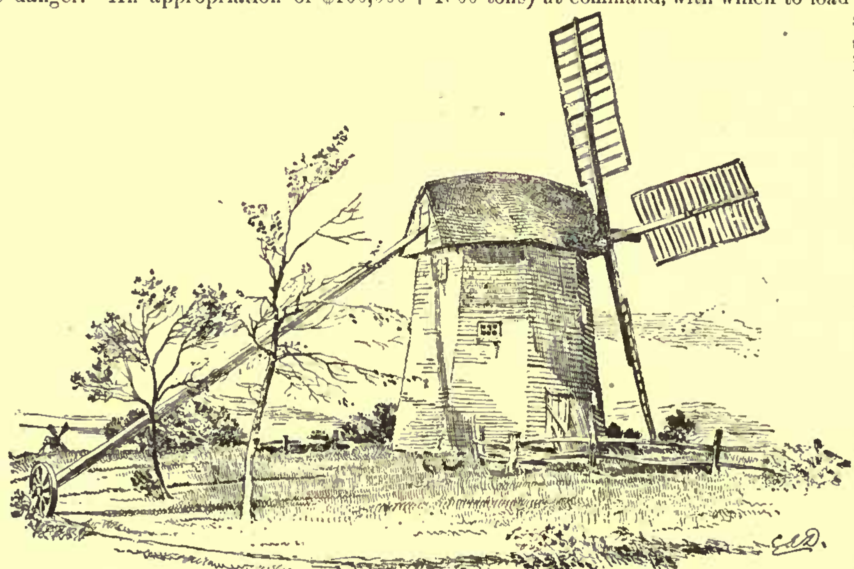
The plan contemplated building first a crib-work or "protection pier," with a large central opening, in which was to be placed a coffer-dam. The water was then to be pumped from the coffer-dam, the rock levelled, to prepare it for the foundation of the light-house, and then the light-house was to be built of stone, carefully cut and strongly fastened together.

The protection pier was built at Scammon's Harbor during 1870–71. In the former year a careful survey was again made at the site, when it was discovered that the hull of the schooner *Nightingale*, wrecked the preceding fall, covered, with her cargo of iron ore, a good portion of the bed of rock on which the tower was to stand. As there was no other place on the reef where bare bed-rock could be found, except in eighteen feet of water, it was necessary to remove that portion of the wreck covering the area required for the coffer-dam.

It was intended to build the light-house of granite, but the contractor utterly failed to furnish this stone. Limestone from Marblehead, Ohio, was therefore purchased in sufficient quantity to continue the work. The coffer-dam was framed at Detroit, Mich., during the winter, and was taken to Scammon's Harbor on the opening of navigation of 1871, to be in readiness for use as soon as the crib should be placed in position.

The original intention was to put this crib in position in four sections, but upon further consideration it was decided to attempt placing it as a whole upon the reef. This was successfully accomplished as follows: four temporary cribs, each fifteen by twenty-five feet, of round timber, were placed in from eight to ten feet of water, in a line corresponding with the proposed eastern face of the pier of protection, and filled to the level of the water with ballast-stone. They were then connected together and decked over. On this deck were placed about seventy cords of ballast-stone, ready at the proper time to be thrown into the pier of protection. The two lower courses of this pier, fastened together with screw-bolts, forming a raft, were towed to the site and moored directly over the position to be occupied by the finished pier. Its position was marked upon the temporary pier mentioned above, and soundings taken at intervals of two feet along each timber in the raft, thus obtaining accurate contours of the surface of the reef within the limit of those timbers. The raft was then towed back to the harbor, hauled out upon ways, and by means of wedges of timber the bottom was made to conform to the surface of the reef. The raft, now become the bottom of the pier of protection, was then launched and additional courses of timber added, until its draught of water was just sufficient to permit its being floated into position on the reef.

Meanwhile five barges at the harbor had been loaded with ballast-stone, making, with that at the temporary pier, 290 cords (about 1800 tons) at command, with which to load the pier of protection and secure it to the reef, as soon as it should be placed in position.


Old Windmill. South Yarmouth. Cape Cod.

This crib was ninety-two feet square, and between eleven and twelve feet high, with a central opening forty-eight feet square. It thus occupied a space nearly a quarter of an acre in extent.

On the evening of the 18th July, 1871, everything being in readiness, and the wind, which had previously been blowing freshly from the northwest for three days, having somewhat moderated, at 8 P. M. two tugs took hold of the immense crib, and started to tow it to the reef, fifteen miles distant, followed by the fleet of stone barges. The construction-scow, with tools, etc., on board, was towed with the crib. At 2 A. M., next day, the fleet hove-to off the reef, awaiting daylight, and the abatement of the wind, which had again freshened up. At half-past six, it having moderated, the pier was placed in position, with considerable difficulty, and after being secured to the temporary pier, and to moorings previously set for it, all hands went to work, and by 4 P. M. had succeeded in throwing 1200 tons of stone into the compartments.

By this time the wind had so increased that the rising sea made it necessary to stop work, but early next morning the rest of the reserve stone was put into the compartments.

After the pier was in position, a schooner was moored on the reef, to serve as temporary quarters for the workmen, who proceeded at once to build up the pier to the required height, twelve feet above water. More stone was brought, and by the 12th of September the pier reached its full height, and, by the 20th, quarters for the workmen were built upon it, when the schooner was discharged. A diver was then employed to clear off the bed-rock within the opening of the pier, and the coffer-dam was commenced.

This coffer-dam consisted of a hollow cylinder, forty-one feet in diameter, composed of wooden staves, each four by six inches, and fifteen feet long; it was braced and trussed internally, and hooped with iron externally to give it the requisite strength. It was put together at the surface of the water, and, when complete, was lowered to its position by means of iron screws.

As soon as it rested on the rock, whose contour was quite irregular, each stave was driven down to fit as closely as possible, and a diver then filled with Portland cement all the openings between its lower end and the rock. A loosely-twisted rope of oakum was then pressed closely down outside the lower end of the coffer-dam, and outside this a larger rope made of hay.

The pumping-machinery having been got ready in the meanwhile,

[1] Continued from page 102, No. 583.

the coffer-dam was pumped dry, and on the same day, October 14, a force of stone-cutters descended to the bottom and commenced the work of levelling-off the bed-rock so as to prepare it for the first course of masonry.

The rock sloped from the west to the east, and, in order to make a level bed, it was necessary to cut down about two feet on the highest side, involving a large amount of hard labor, and rendered still more difficult by the water forcing its way up through the seams in the rock. This work was finally accomplished, as much care being taken to cut and level the bed as with any of the masonry courses. The first course of masonry was set and completed October 27. The water forcing its way through the seams gave much trouble as it disturbed the mortar; for this reason water was let into the dam every evening and pumped out in the morning, to give the mortar time to harden during the night. The mortar was composed of equal parts of Portland cement and screened silicious sand, and became as hard, or harder, than the bed-rock or the stone of which the tower was built.

As the weather now became boisterous, frequent snow-squalls interfering with the work, it was determined to close operations for the season, so everything was put in safety for the winter, and by the end of October all the men had left the rock except two, who were left to tend the fog-signal and the fourth-order light, which had been erected on the men's quarters; they were taken off at the close of navigation.

The degree of success of this model coffer-dam may be inferred from the fact that, though provided with pumps having an aggregate capacity of 5,000 gallons per minute, not more than a capacity of 700 gallons was used, except when emptying the coffer-dam, and then only to expedite the work; once emptied, a small proportion of this capacity was ample to keep the coffer-dam free from water, and this at a depth of twelve feet of water, on rock, at a distance of eleven miles from the nearest land. Every one connected with this work may well feel a just pride in its success.

The following season opened a month later, so work was not resumed at the harbor until the 3d of May, 1872, and upon the reef on the 20th of the same month. On May 13 the ice was a compact mass of some feet in thickness, and masses of ice lay on top of the pier itself. As soon as possible the ice was cleared away, and the work of setting the additional courses began.

By the close of the season the work had been carried to the seventeenth course inclusive, completing the solid portion of the tower. In September there was a violent storm, and the following account will give some idea of its violence and the damage done:

"The sea burst in the doors and windows of the workmen's quarters, tore up the floors and all the bunks on the side nearest the edge of the pier and the platform between the quarters and the pier. Everything in the quarters was completely demolished except the kitchen, which remained serviceable. The lens, located on top of the quarters was found intact, but out of level. Several timbers on the east side of the crib were driven, in some four inches, and the temporary cribs were completely swept away. The north side was so completely filled up that the steamer can no longer lie there. A stone weighing thirty pounds was thrown across the pier; but the greatest feat accomplished by the gale was the moving of the revolving derrick from the northeast to the southwest corner. At three o'clock in the morning the men were obliged to run for their lives, and the only shelter they found was on the west side of the tower. The sea finally moderated sufficiently to allow them to seek refuge in the small cement shanty standing near the southeast corner of the crib. Many lost their clothing."

During the following winter the workmen's quarters, from which the light had been exhibited, was carried away by the ice, and together with the lantern was totally destroyed. This was not unexpected, and in view of the probable result, the lens had been removed and stored in a place of safety. The fog-signal was uninjured and was sounded whenever required. Work was continued during the working-seasons of 1873–4, and the light was exhibited for the first time on the night of June 1, 1874.

The exterior of the tower is a frustum of a cone, thirty-two feet in diameter at the base and eighteen feet at the spring of the cornice, eighty feet above the base. The cornice is six feet high and the parapet seven feet. The focal plane is four feet three inches above the parapet. Hence the entire height of the masonry above the base is ninety-three feet, and of the focal plane ninety-seven feet three inches.

The tower is solid to a height of thirty-four feet; above this it is hollow, and divided into five stories, each fourteen feet in diameter. The walls of the hollow portion start with a thickness of five feet six and three-tenths inches, and are eighteen inches thick at the spring of the cornice. The whole interior is lined with a brick wall four inches thick, separated from the outer wall by an air-space of two inches. All stones below the cornice have a uniform thickness of two feet. All sashes, shutters, and doors are made to open outward, which admits of such an arrangement of the rabbets as to effectually prevent the entrance of water at the window and door openings.

The stones in the solid portion are cut to form, in the simplest manner, a most complete lock upon each other in each course, and the several courses are bolted to each other with wrought-iron bolts two and one-half inches in diameter and two feet long. The lower course is bolted to the rock with bolts three feet in length, which penetrate the rock to a depth of twenty-one inches. All the bolts are wedged at each end with conical wedges, and all bolt-holes are filled solidly with pure Portland-cement mortar.

Above the solid portion no bolts are used except in the first course, but on the build of each course a ribbon has been cut, fitting into a corresponding recess in the course above.

The reader will notice the similiarity of the "bond" in this tower to that used at Minot's Ledge.

Deducting the time while work was suspended for the winter, and that consumed in giving notice to mariners, the aggregate working-time was twenty-four months, but as at least two week's time was lost at the beginning and end of each season getting ready for and in securing the work, the actual available time did not exceed twenty months.

The total cost, including the steamer and appliances of every kind was, in round numbers $375,000.

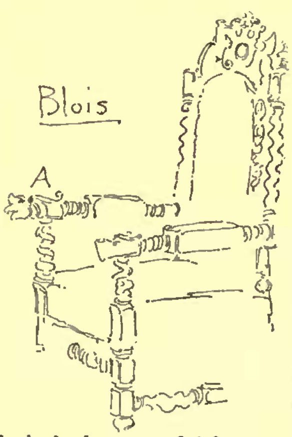
The crib and coffer-dam were designed by Col. and Bvt. Brig.-Genl. W. F. Reynolds, and the tower by Lt. Col. and Bvt. Brig.-Genl. O. M. Poe, both of the Corps of Engineers of the United States Army. The latter officer had charge of the difficult part of the work until the foundation was brought above water. The tower was completed by Maj. and Bvt.-Brig.-Gen. Godfrey Weitzel, Corps of Engineers, since deceased. Any account of Spectacle Reef Light-House should give much credit to Mr. Anthony L. Ederle who was the Superintendent of Construction from the beginning until the completion of all work of any difficulty.

The construction-pier, which has been repaired from time to time, is still standing, and is most useful as a landing-place and a site for the steam fog-whistles.

Of late years, however, it has become much deteriorated and is beyond economical repair; next summer the Light-house Board will probably build an iron caisson filled with concrete adjacent to the tower, to form a foundation for the fog-signal apparatus, after which it will be a matter of little moment whether the construction-pier is destroyed or not.

[To be continued.]

PICTURES OF THE SEASON IN NEW YORK.[1]—II.



FEWER pictures than last year were shown this winter at the Water-Color Exhibition. As this meant that a more careful selection had been made among the submitted drawings, the collection was of higher average excellence, and contained a smaller number of distinctly bad attempts. Some of our best aquarellists were absent including Mr. Abbey; and others, like Mr. Winslow Homer, were represented by comparatively unimportant works. But Mr. La Farge sent three or four exquisite little figure-drawings, among which was a first-fruit of his recent journey in Japan — a marvellously painted "Masked Dancer." Mr. Alden Weir was represented by a child's portrait, which lacked the superficial prettiness often thought essential to such work but was distinguished instead by a serious and dignified expression of character, secured without the least exaggeration of infantile simplicity; and by several figure-compositions among which was one called "Consolation." Showing the figures of a young mother in deep mourning and a little child, it was the most noteworthy picture in the exhibition as regarded deep and vital meaning — very clear in suggestion and infinitely touching, full of sentiment yet beautifully simple and devoid of all taint of sentimentality. Mr. Kappes sent a most admirable negro *genre;* Mr. Léon Moran some dainty yet vital and expressive eighteenth-century figure-subjects; Mr. Homer Martin some charmingly poetical English landscapes; Mrs. Nicholls a strong and interesting if, in the expression of character, not wholly successful scene from the "*Scarlet Letter*"; and Mr. Robert Blum sundry little Dutch figure-subjects, admirably fresh and free in their execution and in the way they rendered character by a process of briefest suggestion. The most striking thing in the collection, technically considered, was Miss Greatorex's large still-life called "Russian Tea"; and it was as fine in color and composition as in handling.

The Society of Etchers exhibited, as usual, in conjunction with the aquarellists. But their collection was not of a sort to satisfy those who have been hoping for a fulfilment of the promise our etchers suddenly gave a few years ago. The popular demand for large, showy and "highly finished" prints has turned the tide of production away from the truest goal of the art, and (though there were a few honorable exceptions) most of the contributions were larger in size than in meaning, were conceived rather in the painter's than in the etcher's spirit, and were marked by a kind of execution that was laborious rather than truly accomplished.

As a contrast Mr. Keppel has recently shown us a complete collection of the works of Millet who was the greatest etcher of modern times, if we make close adherence to the most characteristic technical qualities and use of the deepest expressional possibilities of the art our

[1] Continued from page 136, number 586.

tests. No man since Rembrandt has felt the potency of lines, as distinct from the potency of tones, so clearly as Millet. No one has conveyed so much with so few lines or made each and every stroke of the needle to bear so deep a message. No man has put such profound feeling into his etchings and no one has expressed it so forcibly or so succinctly. The collection — recently purchased from M. Lebrun in Paris — is not only complete (containing every print of every kind which Millet is known to have produced and every "stage" of each) but the only complete one which ever can be formed. Many of the prints it contains are very rare and no less than eight are pronounced by M. Lebrun's catalogue to be unique. In addition to etchings it contains lithographs, heliographs printed from glass, and wood-cuts — a few of the last not only drawn but cut by the artist himself and others drawn by him on the wood and cut by others. Those cut by his brothers are truly marvellous examples of that phase of the art which was developed in its earliest years and is so entirely different, alike in method and effect, from the phase we know to-day. The process is one of black not of white line; and the lines are very few, extremely strong and simple upon a broad untouched background. So *naïf* is the execution that one thinks perforce of the knives and planks of the sixteenth century rather than of the burins and blocks of the nineteenth. And so strong and *naïf* is the feeling expressed that thus also one is reminded far more of Dürer and his school than of modern Paris. But in the *kind* of feeling expressed there is no analogy with mediæval or renaissance moods. Millet is as much himself in these wood-cuts as in his etchings or paintings; and that self is one of the most characteristic products of modern as distinct from earlier ways of thought.

Many of the etchings show again the same subjects with which certain of his famous paintings have made us familiar. And how strong a hold these subjects had taken upon his imagination — how clearly he not only felt but *saw* them with the eyes of his mind and heart — is proved by the exact analogy in face and attitude and expression which each etched figure bears to its painted fellow. But how true was his artistic instinct, how accurately he knew and how completely he controlled the different technical methods he employed, is also proved by such a comparison. The "message" is the same, whether delivered by brush or needle. But the needle never tries to imitate the effects produced by the brush. No etching is in the true sense a reproduction of the corresponding picture. It is the same conception but translated into a different artistic tongue and as simply, frankly and characteristically as though it had not already once been told in another tongue. Seventy-seven numbers in all are included in the collection which Mr. Keppel refuses to break but offers for sale as a whole for the sum of $4,000. Considering that it is unique as well as intrinsically so interesting this price cannot be called high. Some individual or institution should surely be found to purchase it for the public, for it is just such a collection as would be of value for popular as well as for technical training. It shows the inmost soul of that artist who among all modern men had the deepest, freshest feeling and the greatest power of speaking to the noblest emotions of man; and it shows the truest, most individual kind of success which, technically speaking, can be obtained with the etcher's tools.

A greater artist than Millet, even, has been revealed to the New York public this winter, not in a long series of works but in what will sometimes afford as clear if not as full a revelation — in a single canvas that is really representative. It is nearly two years, I believe, since Mr. Schaus purchased from the Duc de Morny, Rembrandt's famous "Gilder." But no one had seen it till the early part of this winter when it was shown for a short time in his store. Now it hangs in his home, among certain choice modern canvases — so good that even a Rembrandt does not put them out of countenance — and may there be seen from time to time by those who are fortunate enough to secure cards of invitation. Much as one had heard of it, distinctly as one had known it to be not only an unquestioned original but a famous and in the truest sense characteristic example of its author's best work in portraiture, the sight of it was a surprise of the happiest sort. For it is intrinsically finer than words could suggest, and is in absolutely perfect condition. The Rembrandts I know best are those in the Dresden collection — many in number and, as regards the portraits, most excellent in quality. But none of the Dresden Rembrandt portraits was ever so fine as Mr. Schaus's in conception and execution save only the well-known "Saskia with the Pink" which is almost contemporaneous in date; and not one of them all is in nearly such good condition. Had the "Gilder" been painted yesterday it could not be fresher, more flawless or more evidently free from the cleaner's or the "restorer's" ravages. All that time has done has been in the way of improvement — for it seems as though its beautiful golden tone, so clear yet so deep, so pure yet so tender, could not have been the immediate creation of any human hand, even a Rembrandt's. Painted in those middle years which were the best years of the artist's life, it shows his method at a time when it had outgrown the somewhat over-accented definition of earlier years but had not yet developed into the extreme breadth (passing at times into bold summarization) of a later period. As a manner, nothing could be more perfectly balanced, more complete, more consummately true and at the same time artistic. Everything is told about every item of the face — we see the man exactly and wholly as we should have seen him in life. But nothing is over-emphasized or so presented as to injure breadth of effect. We see all details but we see them as we do in a living face — almost forgetting them in noting the total result in its form and color and expression. As a piece of drawing the work is far above all praise. And in color it is surpassingly beautiful. It was a few years after the date which this picture bears that Rembrandt developed his coloristic power most brilliantly — painted those dusky, sun-streaked interiors lighted with jewel-touches of gorgeous hues which are so different from the broadly massed results of the great Venetians yet are absolutely on a par with them in coloristic beauty. But even when this portrait was painted he had complete control of the soberer resources of his palette and had perfectly developed that "golden-brown tone" which is considered the distinguishing mark of his best period. A painter who wants to know what *good painting* means will find the term perfectly explained in this picture — which is so well painted that it seems to be painted in the only possible way; seems to say, this is the way to do it — why does any one ever do differently? And one who wants to know what good tone and color and atmosphere mean, and what it means to paint character and soul as well as body will also find the answers here, as convincingly given as by any portrait in the world. The beauty of it all is that it looks so simple, so natural, so easy, so *necessary*. But this, I need hardly say, is the aspect which distinguishes a very great work of art in each and every department and never any but the very greatest.

"Down-town" auction-sales have been even more frequent than usual this winter, and an even higher degree of excellence has been claimed for the wares they offer. But these wares have so seldom in the past supported the claims made for them by their advertisers that even the newspapers rarely mention them except in their advertising columns and the truly art-loving public never gives them a thought. One wonders equally where all these pictures come from and where they possibly can all go to.

Up-town the season has brought out a number of collections that successively have come beneath the hammer with good pecuniary results. The first was Mr. Robinson's collection of modern pictures which professed to have great historical value as containing a systematic assortment of works by the most noted Continental masters of the century. But most of the examples were small and unimportant; some of them were not, truly speaking, representative; and the best were studies or sketches rather than finished pictures.

The Graves collection was very large and very various. Most of its contents were distinctly poor; but among them were some good French landscapes, including several admirable Michels.

The A. T. Stewart collection, still on exhibition as I write, has not excited half so much popular attention as did the Morgan collection last year — a proof that our public *has* some feeling for intrinsic excellence in art as well as for mere notoriety. For in no other respect save notoriety is this collection entitled to even a comparison with the other. Never was such a dreary waste of commonplace, broken by so many absolutely inferior works and by so few of distinct superiority. Rosa Bonheur's "Horse Fair" is worthy of its fame as an admirable, interesting, strong and serious piece of work, if not a great creation or one which shows a very individual artistic temperament. Her brother Auguste's "Forest of Fontainebleau" is still better — not so vigorous in intention or so immediately effective, but as sincere, much more individual in feeling, and far more poetical than anything Rosa Bonheur ever painted or could paint. Gérôme's famous "Gladiators" has all the excellence with which the engravings have made us familiar but not a particle more. Indeed the hardness of its execution and the disagreeable quality of its color make it less attractive than the black-and-white reproductions. But another work by the same hand, an interior with two figures, is infinitely better in color and in execution than his works are apt to be — really a beautiful as well as a clever picture. Zamacois's "Court Jesters" is another well-known and excellent picture. Benjamin Constant is represented by a fresh and brilliant Oriental scene, and Munkácsy by a modern interior which shows him to far better advantage than the big "Christ before Pilate." One or two of the Bouguereaus are good of their kind.

French landscapes are almost wholly wanting, but there is one D'Aubigny of fair quality and two Troyons — interesting, of course, but too early to be really representative. There are two pictures by De Nittis, clever but not of his best; a rather early and not very attractive Détaille; a charming fantastic Michetti; an Alfred Stevens which cannot be called very characteristic; and certain "old masters," some of which are really good as well as really old, though very surely not the work of those whose names they bear. And then there are two small and second-rate Meissoniers and the famous big "Friedland — 1807," which is as far inferior in quality and interest to a truly good Meissonier as it is superior in size. If any one has wanted to know the difference between great and merely clever painting he could not have had a better object-lesson than that afforded by a comparison between the sky of the adjacent Daubigny landscape and the sky of the "Friedland." Of course the picture is well-drawn; but it is not well composed and is extremely bad in color and weak in dramatic expression. And in execution it is sometimes empty and sometimes so over-minute as to produce a singular hardness and unreality of effect. One is curious to know who will buy it and what he will be willing to pay for it. But it certainly will not be purchased by any one who knows what a good Meissonier means and wishes to possess one.

There are many American pictures in the collection, but few of them — scarcely one perhaps except a certain little figure by Beaufain Irving — will do much to raise the spirits of the patriotic

visitors. And finally there is a good but short series of works by Spanish-Roman painters, culminating in the two gems of the collection—Fortuny's "Snake-Charmers" and his "Beach at Portici." The former is a comparatively early work, low in tone but very rich in color and admirably strong in handling. The latter is the last work upon which he ever labored and was left incomplete at his death—a magnificent rhapsody of brilliant hues pitched in a high, strong scale; a work so unconventional yet so true in its own new way, so audacious yet so earnest, so striking yet so satisfying, so vigorous yet so poetic, so strange and yet so laudable that it explains at once the enormous influence that this great and individual master has exercised upon the living generation of painters.

The collection of bric-à-brac and furniture is large but for the most part devoid of all artistic value. The catalogue of the library contains less than five hundred entries, but speaks of many fine illustrated works—among others, of the Marquis of Kingsbury's "*Mexico*" and of a copy of the "*Nurembery Chronicle.*" There are many things in the various collections which the public might gladly have owned. But as a whole they would have been more of a burden than a benefit had they been bequeathed, as many hoped they would be, to the public's keeping.

Mr. Wm. M. Chase recently exhibited and sold in our city that interesting collection of his works which was shown in Boston earlier in the winter. Every one admired the pictures, and artists and connoisseurs even more than the general public. But they did not sell for anything like their true value, while poor or bad or even unauthentic foreign works have been selling month by month for much more than theirs.

Mr. Whittredge, one of the oldest and most earnest of our landscape painters, also sold a large collection of his pictures a few days ago. And as a contrast to these we may now see the collected works of two of our youngest landscape painters—the late William Bliss Baker and Mr. Charles H. Davis. The former was a product of home instruction, and, so to say, a "realist." The latter, after studying in Boston, has spent six years in Paris under the tutelage of Boulanger and Le Febvre, and is distinctly to be called an "idealist." But Mr. Baker's prose does not lack for individuality and charm, and Mr. Davis's poetry has a very firm basis of reality to rest upon. Each is an excellent workman in his own way and it is well that our landscape art should not be developed in one way only. Mr. Baker's pictures are soon to be sold at auction and an appreciative public is to be hoped for them. Mr. Davis's are already meeting with such a public, seventeen out of fifty-three having been sold for good prices after only four days of exhibition.

M. G. van Rensselaer.

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE FIRST METHODIST EPISCOPAL CHURCH, ST. PAUL'S AND FOURTH STREETS, BALTIMORE, MD. MESSRS. McKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial and Gelatine Editions.]

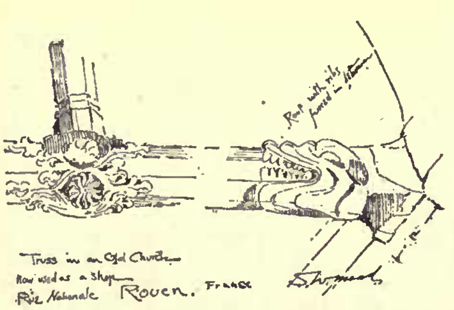
COMPETITIVE DESIGN FOR THE CARNEGIE LIBRARY, PITTSBURGH, PA. MR. J. L. FAXON, ARCHITECT, BOSTON, MASS.

MERCERY LANE, CANTERBURY, AFTER AN ETCHING BY CHARLES J. WATSON.

SPECTACLE-REEF LIGHT-HOUSE.

For description see article on "Ancient and Modern Light-houses."

EARTHQUAKES.[1]



From all quarters have come to me inquiries about the earthquake in Charleston. Because I am a teacher of geology it has been taken for granted, quite gratuitously, that I know or ought to know, all about the earth of which the structure and history are the geologist's special objects of study. That he knows more about these than other people is possible, but that he knows all about them is unfortunately far from true. It is, however, natural that I should be appealed to for information in regard to what is the most striking of all terrestrial phenomena; and while I do not claim nor accept the title of "Professor of Earthquakes," which one correspondent seriously gives me, I acknowledge it as a part of my duty to satisfy, as far as I am able, the demand which has been made by the public. . . .

Briefly told, an earthquake is a movement caused by a shrinking, from the loss of heat, of the heated interior of the earth, and the crushing together and displacement of the rigid exterior as it accommodates itself to the contracting nucleus. . . .

From observations in mines, and from deep borings, from hot springs and volcanoes, we have learned that the interior of the earth is intensely hot. The most satisfactory data for this conclusion are furnished by wells and mines. These are located in all the great divisions of the earth's surface: China, India, Australia, Africa, Europe, and North and South America, all have their mines or deep borings, which give fairly harmonious testimony upon this subject. They prove that after passing the plane of invariable temperature, beyond which the alternations of the seasons are not felt, the heat increases about 1° Fahrenheit for every 50 feet. For example, the well in the grounds of the Lunatic Asylum at St. Louis, is 3843 feet in depth; at 3200 feet, where the temperature was last observed, it was 107°; the State-House well, at Columbus, Ohio, is 2775 feet deep, and at 2575 feet the temperature is 88°. The artesian well at Louisville, Kentucky, is 2080 feet deep, and the temperature at the bottom is 82° summer and winter. Other wells bored in the Valley of the Mississippi and in the Eastern States furnish similar data. . . .

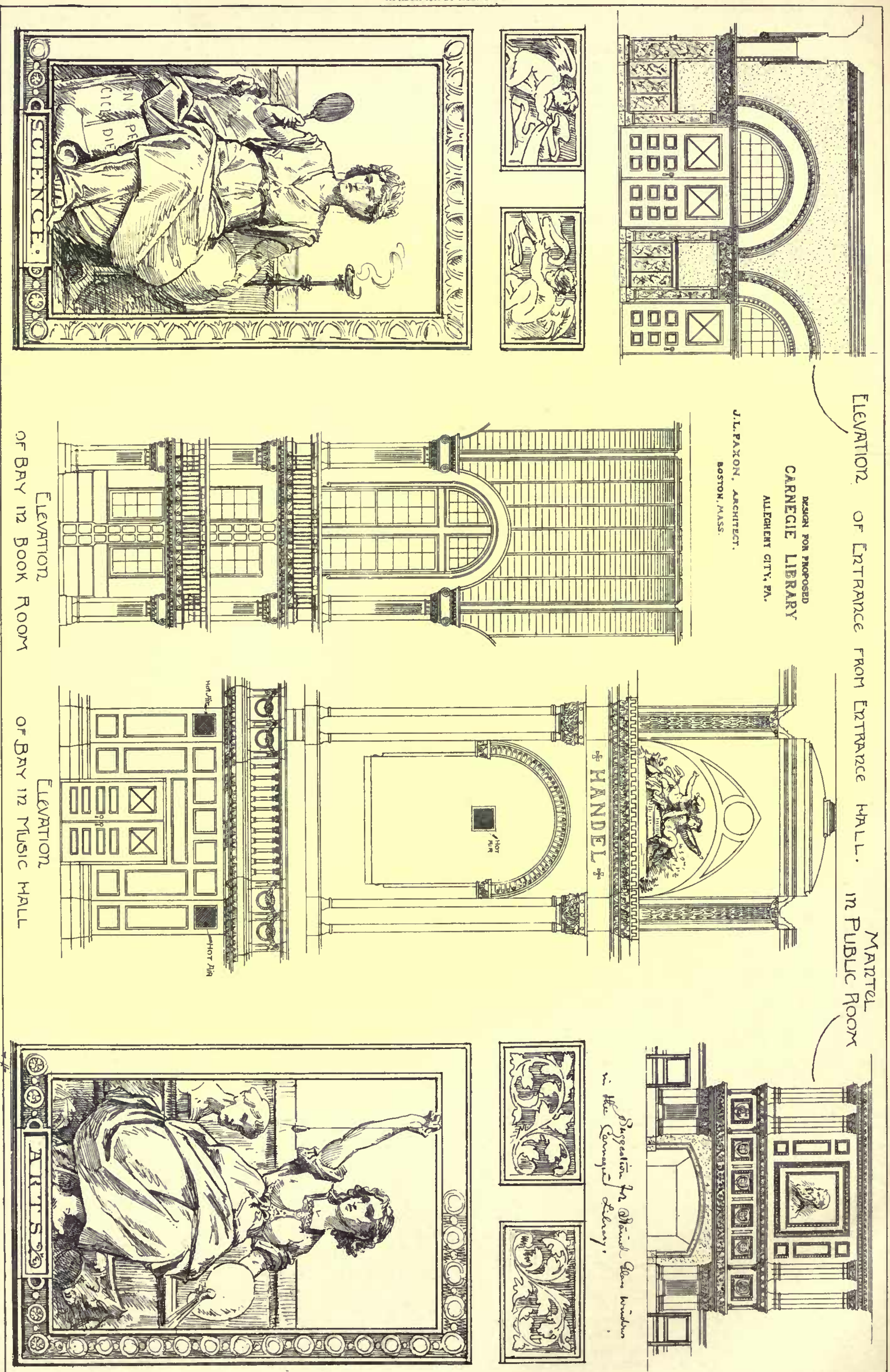
It may then be considered as established that all over the earth's surface, except in volcanic districts, the temperature increases about 1° Fahrenheit for every 50 feet descent. It is evident that should this rate of increase continue the temperature at the depth of fifty miles would be sufficient to melt all known substances, and the first conclusion from the observations of temperature in mines and wells was that the solid portion or crust of the earth could not be more than forty or fifty miles in thickness, and it was proclaimed that we were living on a film of solid matter, floating on a sea of molten rock. The comparative stability, however, of the earth's figure—the little effect produced by the attraction of the sun and moon—have led to the conclusion that the earth's crust is thicker than this, and it has been suggested that while the accuracy of the observations on the increase of temperature to the depth of one mile cannot be questioned, it is possible that the rate of increase to that depth is not constant below; that the increment may diminish, and therefore, the temperature of fusion may only be reached at a greater depth than has been supposed.

It has also been shown that the melting point of many substances is raised by pressure, and therefore, that the enormous weight of the overlying rocks, equivalent to 5,280,000 pounds to the square foot for every mile, may hold in coerced rigidity a considerable zone of the earth's mass composed of materials that would melt and flow on the surface at a much lower temperature than that which they now endure in a solid form. Accepting, then, the conditions imposed on the old theory of the state of the interior of the earth by pressure, and the possible diminution of the increment of temperature, we may suppose that the solid crust is considerably thicker than was formerly supposed. That it is relatively thin, however, is indicated by facts which will be cited farther on.

The increase in temperature observed in mines and deep borings means that the heat of the interior of the earth is constantly escaping to the surface, where it is radiated into space. If the outer crust were a perfect non-conductor the materials within it would always maintain a condition of thermal equilibrium throughout. It is thus evident that the process of refrigeration is progressive, and from the time when the first film of solid matter dimmed the brightness of the "glittering globe of liquid fire," the crust formed at the surface has been constantly increasing in thickness, while by the loss of heat, which is an expansive force antagonistic to gravity, the volume of the earth has been as constantly diminishing. But since the outer crust has lost its inherent heat and has become solid it no longer shrinks, though the loss of volume goes on incessantly in the intensely heated, but gradually cooling interior. As the nucleus contracts, the solid crust cannot accommodate itself moment by moment to the loss of volume, for it resists by its rigidity, and is brought into a state of strain. This is relieved from time to time, whenever it passes the resistance of the materials composing the crust, by a crushing together and displacement of the surface rocks. These are *faulted* or *folded;* that is, are either thrown into great waves by lateral pressure, or the arches are broken and fissures are produced at right angles to the line of thrust. The rocks forming the sides of these fissures slide on each other, forming what geologists call *faults*, in which the "throw" or displacement sometimes amounts to many thousand feet. Earthquakes, mountain chains and volcanic eruptions may all be considered as consequences of this readjustment. Mountain chains are great lines of fracture in the earth's crust along which rocks, before nearly horizontal, are raised into ridges by lateral pressure. They have been compared, not inaptly, to the wrinkles formed in the rind of a fruit when it loses its volume by drying. . . .

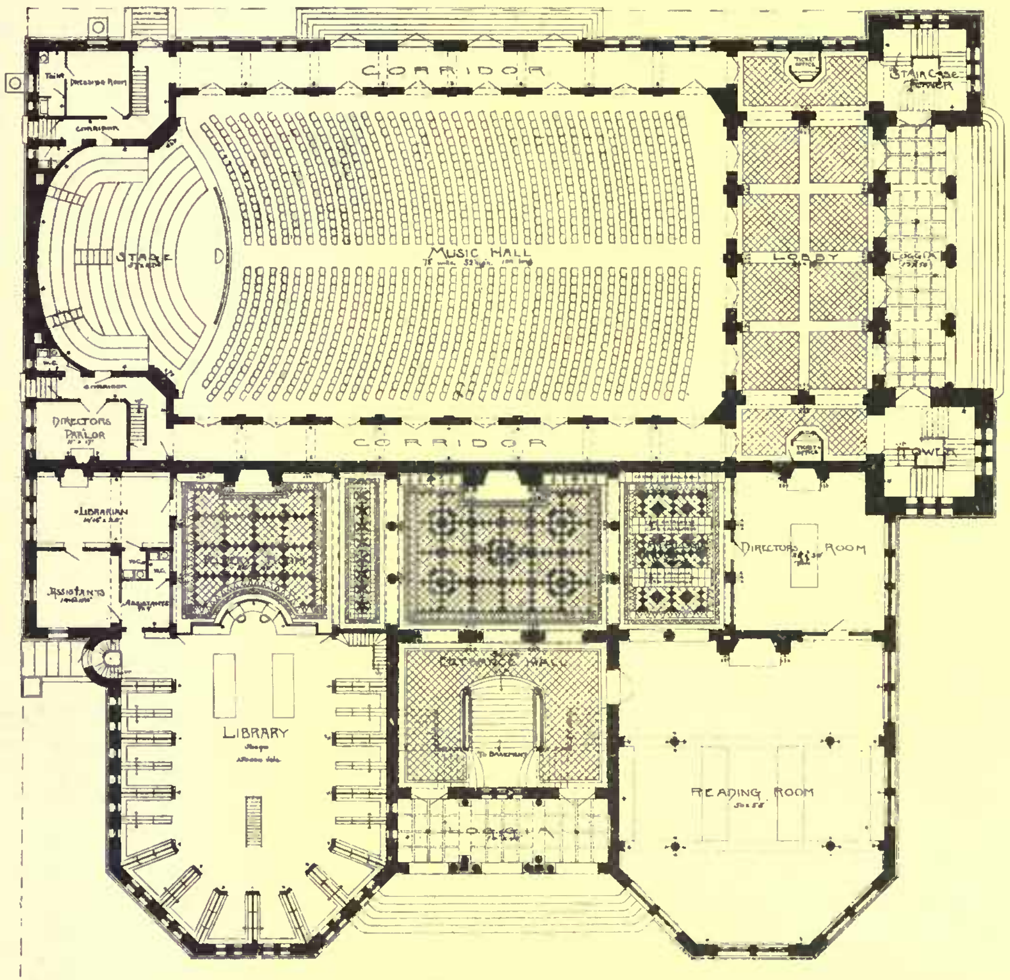
Another thing about mountain chains is not so generally known as that they are lines or belts of folded and fractured rocks, and that is that they are the products not of moments or even years, but of ages. The lines of fracture which are marked by mountain chains

[1] Extracts from a paper by Prof. J. S. Newberry in *The School of Mines Quarterly*, for October, 1886.

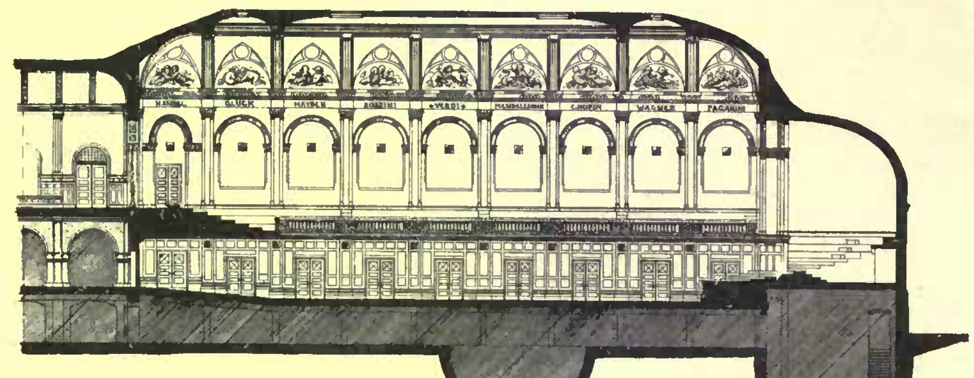


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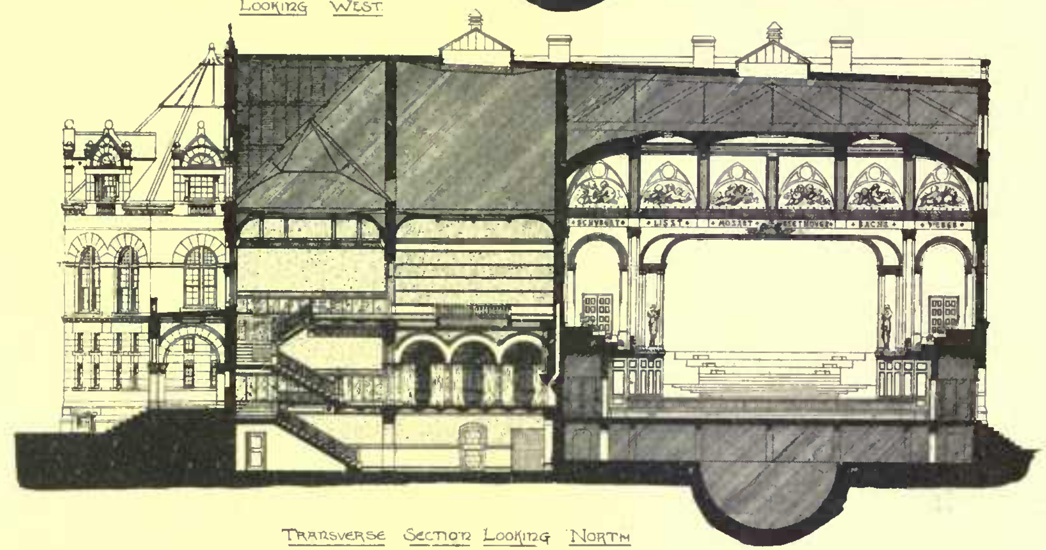




PLAN OF FIRST STORY

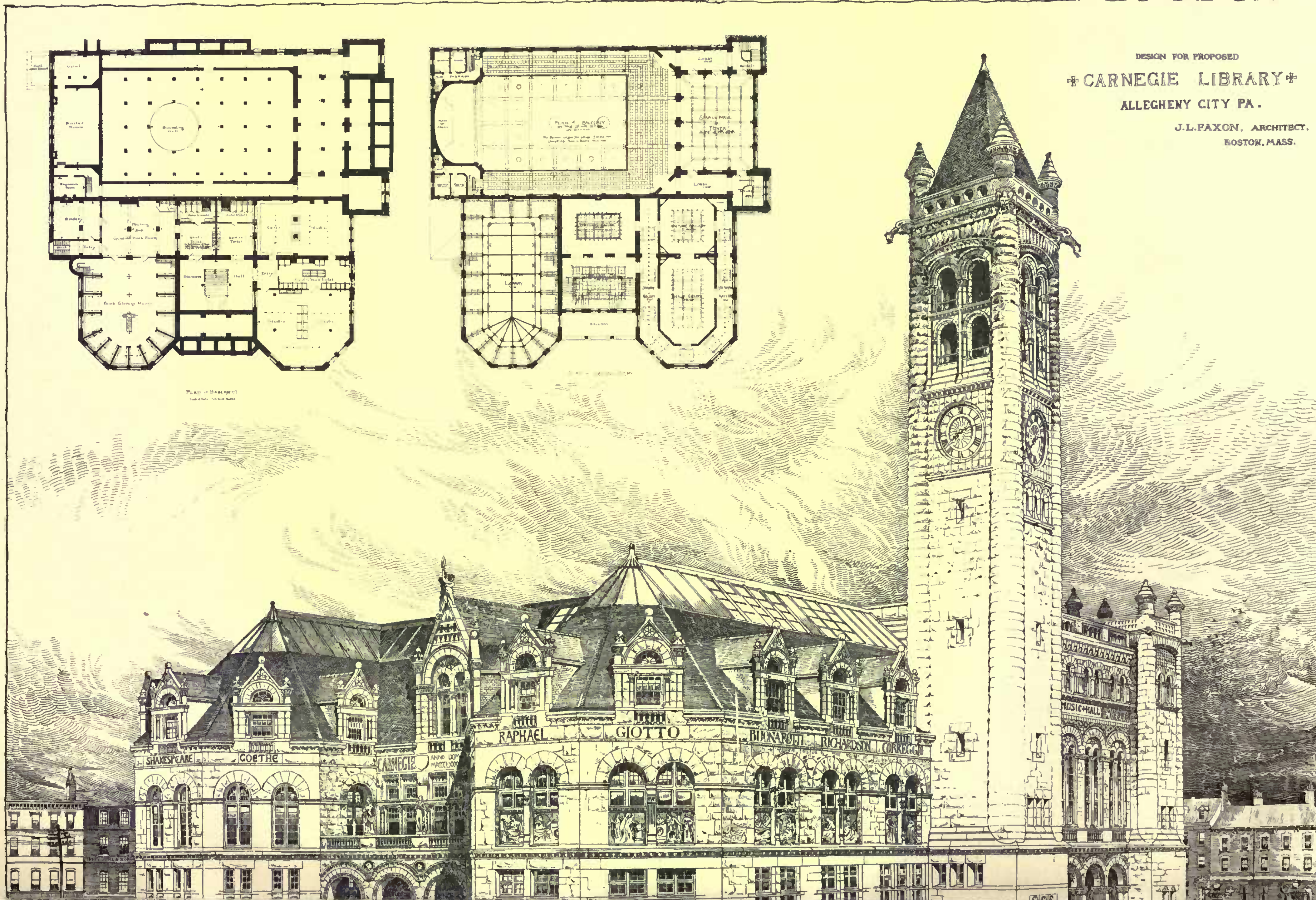


LONGITUDINAL SECTION OF MUSIC HALL LOOKING WEST



TRANSVERSE SECTION LOOKING NORTH

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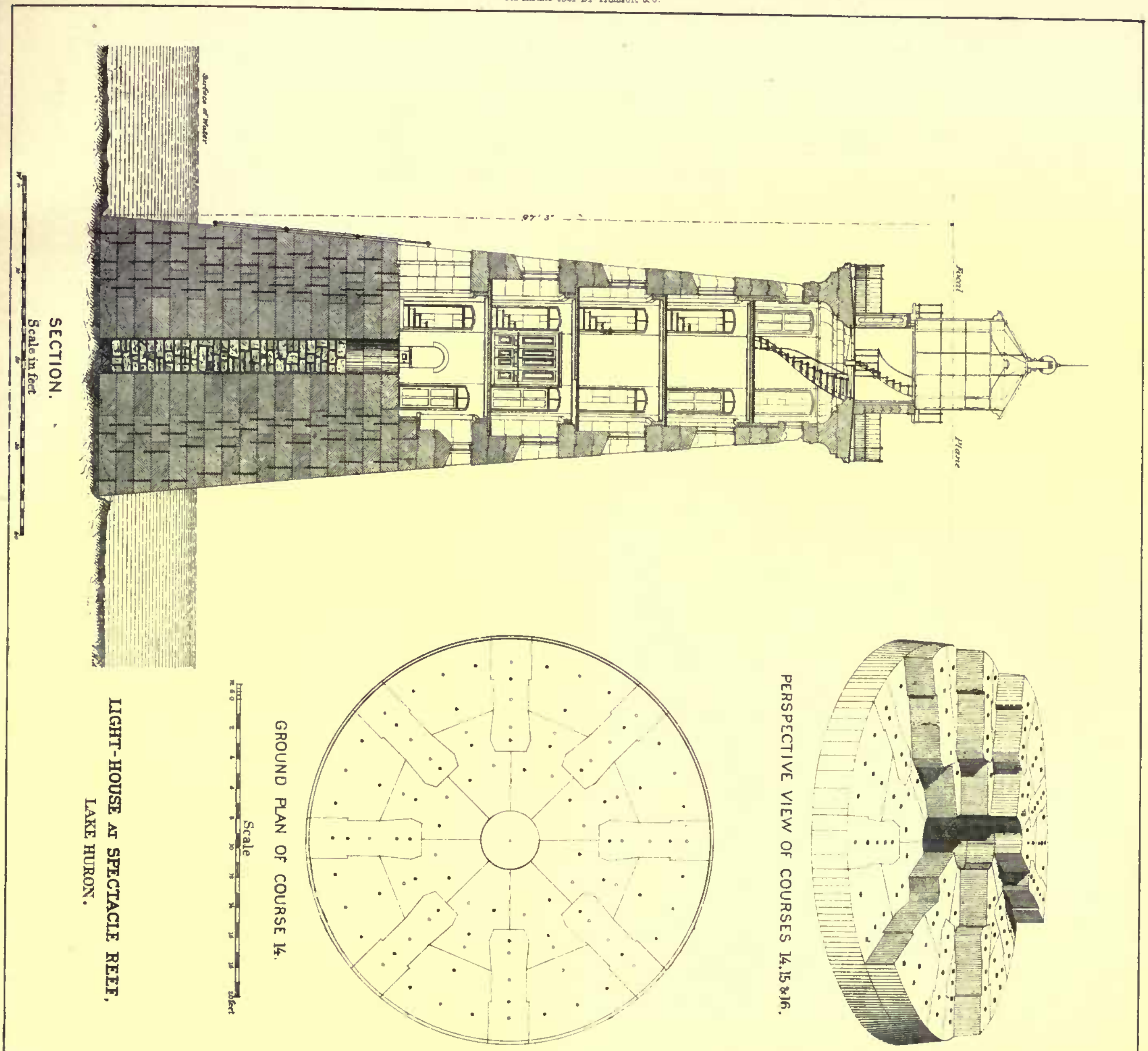


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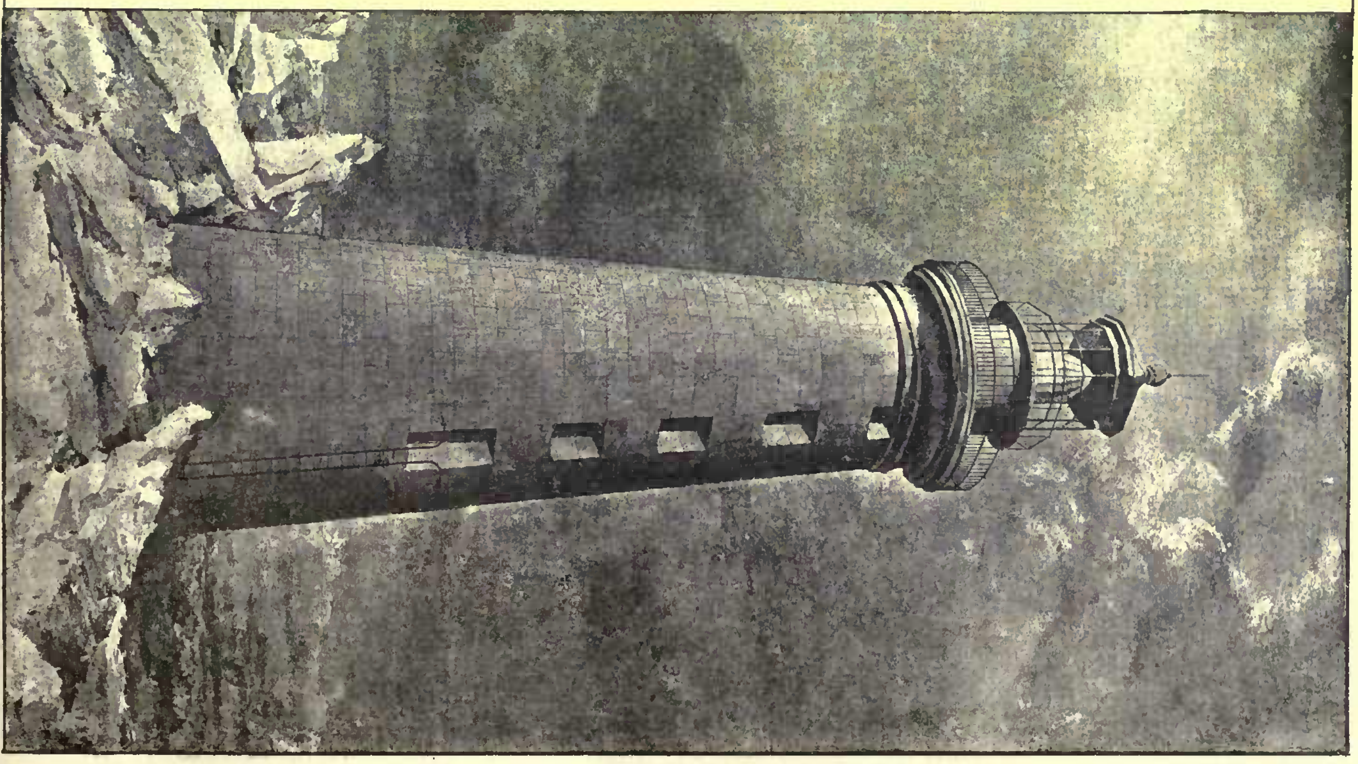


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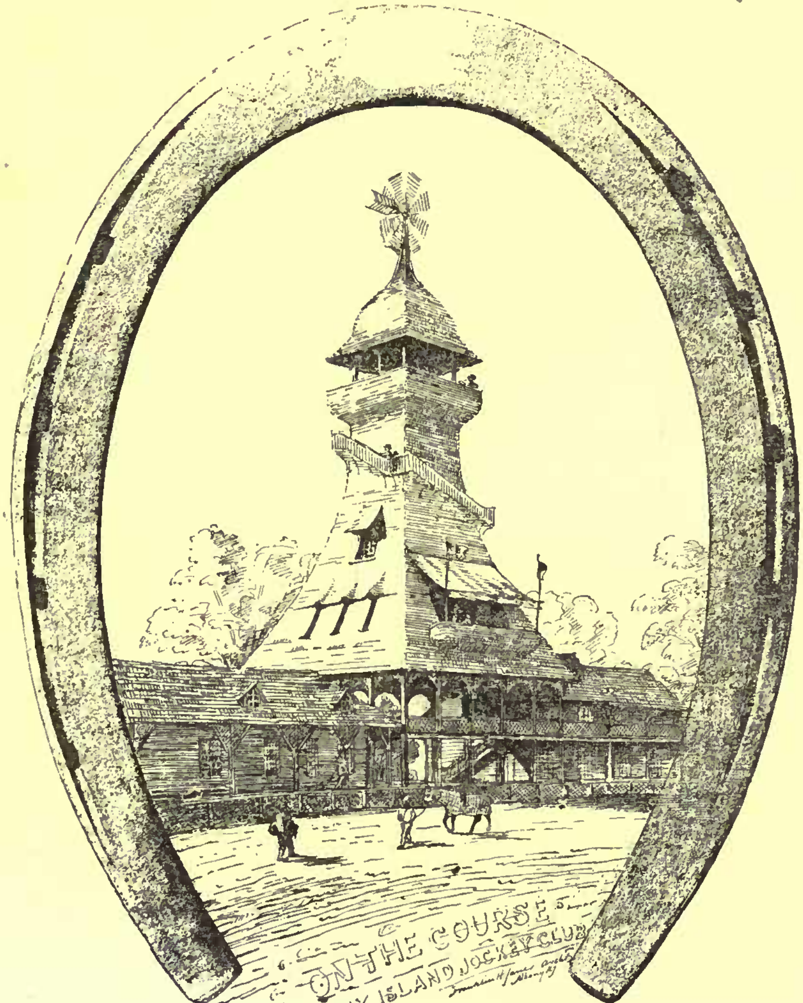
LIGHT-HOUSE at SPECTACLE REEF,
LAKE HURON.



Heliotype Printing Co. Boston

are ever, after the first disruption, lines of weakness, where the resistance to lateral pressure is diminished, and where the strain of large unbroken areas is relieved from time to time by displacements, necessarily attended by earthquakes. I have sometimes compared them to hinges on which the great tables of the earth's crust turn with constantly changing angles. Generally mountain chains may be said to grow by the constant or paroxysmal elevation of their arches, the increase in the throw of their faults. This growth would be much more apparent than it is if it were not that the mountain chains receive a far greater precipitation of moisture than the lowlands, and erosion, which is the opposing force to elevation, counteracts its effects. The East Indian geologists estimate that in the Himalayas the process of elevation is going on constantly and that it is at least equal to the loss by denudation. . . .

It will be noticed that, in the reports which have been given of the Charleston earthquake, there is an absence of all reference to the explosions which have been among the most striking and destructive phenomena of earthquake action in some localities. Thus in the description of the great earthquake of Riobamba, Equador, in which 40,000 persons perished, it is said that the bodies of many of the inhabitants were thrown upon a hill which rose to the height of 100 feet on the other side of a stream; and, during the earthquake of Chili, in 1837, a mast, planted 30 feet deep, was thrown out so that a round hole remained behind. These, which are called explosive earthquakes, have been confined to the vicinity of volcanoes and to districts bordering on the sea, and it is supposed that, by the disruption of the rocks, large quantities of water have been suddenly brought into contact with melted lava. Steam has played an important part in most volcanic eruptions, though, as a secondary, and not, as often supposed, a primary cause. Masses of molten matter, welling up through fissures in the earth's crust, must necessarily come in contact with subterranean reservoirs of water, or with strata saturated with moisture. In the vicinity of the sea, too, where most volcanoes are located, water may be admitted in the manner just described. In all these cases, steam would be generated in such quantities as to make this an efficient adjuvant to the lava flood in producing disruption, upheaval, and vibrations of the rocks. The absence of these violent features in the earthquakes of the country bordering the Alleghany belt, proves that volcanic action has had nothing to do with them, and shows that, like a vast majority of earthquakes elsewhere, these have been, as Dana says, "incidental phenomena in the process of mountain building"; that is, they are sensible signs of the lateral movement of the earth's crust, which results in the crushing, folding, faulting, elevation and metamorphism which are distinctive features of all mountain belts and chains. . . .



As is mentioned in the early part of this article, the first result of the discovery of the law of increase of temperature in going toward the centre of the earth, was the conclusion that the solid crust was not more than fifty miles in thickness, and below that was a sea of fluid or semi-fluid molten matter. Then mountain chains were supposed to be the result of the crushing together of solid sheets of rock as they followed the cooling and shrinking interior. The coat becoming too large, and adhering to the body, must wrinkle as the body shrank. Volcanic eruptions were supposed to be the oozing out of molten matter from the not distant zone of fused material, and all was harmonious in the geological world. Then came Professor Hopkins, Archdeacon Pratt, and Sir William Thompson, in the character of disturbers of the public peace; they said that the crust would be broken up by tides if it was as thin as supposed; that the shell would be pulled about on the fluid nucleus by the attraction of the moon on the equatorial protuberance; and, finally, that the tenacity with which the figure of the earth was maintained under the varying pull of the sun and moon made it necessary to suppose that it was, as a whole, as rigid as a globe of glass, or even of steel. Sir William Thompson conceded, with some hesitation, that the crust of the earth might not be more than 2500 miles in thickness; further than that, he would not go. Since that time, awed by his great and well-deserved fame, geologists have generally accepted the conditions he imposed upon them, and there has been a terrible struggle to reconcile volcanoes, earthquakes and the flexibility of the earth's crust with a solid interior. Some have gone back to Sir Humphrey Davy's theory, that volcanoes were the product of intense chemical action in certain circumscribed portions of the earth's mass; and others have supposed that, between a thick external crust and a solid interior there was an intermediate zone of fused matter from which volcanic ejections emanated. . . .

There would have been no question of the truth of the old theory of vulcanism if it had not been raised by the physicists whose names have been mentioned, and it can now be seen that their objections have little force. Delaunay, of Paris, and Hennessy, of Dublin, have shown that the premises assumed by Thompson, Hopkins and Pratt, in their attempted refutation of the old theory of a comparatively thin crust, are not those of nature, and that their conclusions are, as a consequence, irrelevant and valueless. Their objections were aimed at an incompressible fluid interior and an elastic crust; conditions which do not and could not exist. Besides this there must be a viscous zone of considerable thickness, in which the transition from the solid crust to the liquid interior is very gradual; and it is highly probable that the matter of this viscous zone is not only not itself affected by tidal movements, but that it acts as a buffer between the liquid interior and the solid crust. It should be remembered that the moon's attraction — the chief motor in oceanic tides — is a force applied to a surface moving at the equator about a thousand miles an hour. Even a fluid as thin as water refuses to obey instantly an attracting body. The tidal wave of the ocean is always considerably behind the moon, and in some places, where obstructed by topographical features, it does not reach its destination until some time the next day. It is easy to see that in a tarry, pitchy mass, the response to the moon's attraction would be far less prompt, and also that the tidal waves in zones of different depths and densities would not coincide, and might completely neutralize each other. . . .

The resistance which the internal friction of a viscous body would offer to a force applied with such velocity would be enormously greater. Hence we must conclude that the tidal movement in such a mass, even at the earth's surface, must be very small, and if, as is the case in the interior of the earth, that mass were condensed and constrained by the weight of a crust even a hundred miles in thickness, it would be inappreciable. . . .

It is difficult to imagine how the advocates of the theory of a solid globe can account for the formation of mountain chains, the loftiest and longest of which are quite modern, and it is not perhaps too much to say that these themselves are a refutation of their theory. It is evident that a heated solid globe, as it lost its heat, would either contract bodily, as a red-hot cannon-ball does, or by the more rapid cooling of the outer surface, that would shrink faster than the interior and crack in every direction; a process just the opposite from that which we find recorded in the earth's crust.

But there are other evidences of the flexibility of the earth's crust, which are incompatible with the theory which ascribes to it great thickness. (1) The lines of volcanoes which crown most great mountain chains are located along fissures which seem to be continuous for thousands of miles, and there is apparently good evidence that these fissures penetrate through the entire thickness of the solid

crust. Sometimes the volcanoes are in simultaneous action for several hundreds of miles, and the materials ejected, though showing much variety, are often identical; facts incomprehensible on any other supposition than that they have been drawn from a common reservoir.[1]

(2) Along all the coast lines the evidences of local changes of level now in progress, or included in the records of past time, are so numerous and striking, that the term terra-firma seems singularly ill-chosen; for example, the shores of the Mediterranean abound in evidences of local depressions or elevation, or both, since it has been occupied by civilized man. Of these the temple of Jupiter Se apis, at Baiæ, is one of the most famous, but by no means the only example.

On our own continent the southern portion of Greenland has been gradually sinking for several hundred years. Labrador and Newfoundland are rising; Prince Edward's Island and Cape Breton, according to Gesner, have sunk many feet since they were first occupied by the whites. In Nova Scotia the land is rising; in Northern Maine it is sinking, as also at Cape Cod and Martha's Vineyard, and on the shore of Long Island and New Jersey. Here the subsidence has locally varied from two to twelve feet during the last century. In the West Indies there are many evidences of local change of level; in some cases, of elevation; others of subsidence. In California we find traces of recent and local flexures of the coast which are very striking; at San Diego is an old beach strewed with shells which have not yet lost their colors, twenty feet above the present sea-level. At San Pedro, the port of Los Angeles, the limestone rocks which form the sea cliffs are bored by pholas eighty feet above the water; on the south shore of San Pablo Bay, at a height of twenty feet above the water, is a bank of oyster-shells, four feet in thickness; this descends toward the south, and disappears beneath the surface of San Francisco Bay. Puget Sound, with its many branches, is only the submerged valley of a great river which ran out to sea through the Straits of Fuca when the coast was much higher than now; but the shores are terraced to the height of 1,600 feet above the present water-level; showing that, in recent times, they have been much lower than now. Similar facts with these have been reported from the shores of all the continents, and the islands afford more striking examples of the changes of level; the Windward Islands are only the summits of a lofty mountain chain which was once all above the sea-level, as is shown by the community of species in animals and plants. The Islands of the South Pacific are also the summits of mountains which have been gradually submerged, as has been shown by Dana and Darwin. Coral reefs, which are formed only within 150 feet of the surface, now extend down in continuous walls, 2,000 feet below the water; the growth of the coral having kept pace with the gradual subsidence. Elisé Reclus, in "*La Terre*," and Professor Prestwich, in his "*Geology*," give maps showing the fluctuations of level now in progress along coast lines, and whoever will examine these maps will find it difficult to reconcile these oscillations of the land with a globe solid to its centre, or even with a thick crust. But the changes of level now taking place proceed so slowly that the record of one hundred and fifty years, during which geological observations have been made, or even that of the long period covered by human history, is insignificant, compared with that of the geological ages. Indeed, historical geology is, for the most part, but a transcript from the monuments left by successive and local subsidences of the land, influxes of the sea, and the deposition of strata containing relics of the marine and terrestrial life of the epochs in which these inundations occurred. Scarce any portion of any continent is without traces of the presence of the sea, and, while some of these submergences were doubtless caused by great tides, which ebbed and flowed from one hemisphere into the other, in the manner suggested by Adhémar, it can be easily shown that most of them were occasioned by local subsidences of the land.

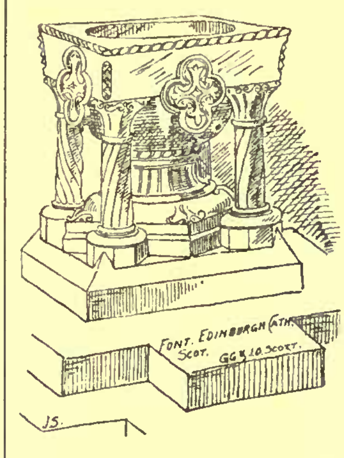
All these lines of evidences, furnished by earthquakes, mountain chains, volcanoes and terrestrial oscillations, converge to one point, and, in combination, go far to prove that the earth's crust is relatively thin, and that its interior is fluid or viscous. . . .

If it is true, as claimed on the preceding pages, that earthquakes are the vibrations attending the folding and breaking of rocks which have been in a state of strain, it is evident that the provoking cause of any special paroxysm might be a comparatively trifling affair — some feather that should break the camel's back. Thus, we have reason to believe that atmospheric conditions may precipitate these catastrophes. The pressure of the atmosphere on the earth's surface is 14.7 pounds to the square inch — that is, a little over 2,000 pounds to the square foot, or about 30,000,000 tons to the square mile. Now it sometimes happens that the mercury oscillates two inches in the tube of a barometer in connection with some violent storm; and it is true that the areas of low and high pressure change position quite rapidly. Hence, if it should happen that the underlying rocks were, from lateral pressure, in a state of strain that had nearly reached the limit of resistance, a change of atmospheric pressure equivalent to two, or even one inch of mercury (equal to 1,000,000 or 2,000,000 tons per mile) might be the cause of a rupture. So, the popular belief, that peculiar atmospheric conditions have had an influence in causing earthquakes, is not so absurd as it might seem.

Another cause which has certainly operated to disturb the static equilibrium of the earth's crust, is the transfer of the products of erosion from the land to the bottom of an adjacent sea-basin. Over all land areas where the rainfall is considerable, there is a constant wearing away of the surface by chemical and mechanical agents. About one-fourth of the material removed is dissolved, and may be carried to the opposite side of the earth before it is precipitated; but the other three-fourths, in the form of gravel, sand and clay, are simply held in suspension by running waters, and are deposited as soon as their motion is arrested. Rivers, rivulets and shore-waves are constantly engaged in transporting material from the land to the deeper water bordering the coasts; there spreading it, to make new series of sedimentary deposits. As these accumulate, they not only impose new burdens on the underlying rocks, but by acting as a blanket and preventing the escape of heat, they promote the softening and weakening of a belt of sea bottom. This process has produced great changes in the surface topography of many continents, and it is credited with the formation of a number of littoral mountain chains. The blanketed belt of off-shore sea-bottom, softened by heat, yields to lateral pressure and is forced up in a series of faults and folds. There is little doubt that the loading of the sea-bottom with the products of erosion has been one cause of the earthquake vibrations which have been so frequent along our Atlantic coast.

[1] Darwin mentions (Trans. Geol. Soc., March, 1838), that in the Andes the volcanoes Osorno, in lat. 48° S., Concagua, in 32° S., and Coseguina, in lat. 13° N., burst into eruption simultaneously on the 20th of January, 1835. The more remote of the three are 3,700 miles apart.

UTILIZATION OF TOWN SEWAGE BY IRRIGATION.[2] — III.



We now come to the hygienic aspect of sewage-farming, which is classed under three heads. I dealt with some of these objections so fully, when the subject was discussed by the Society after the reading of Dr. Tidy's paper, that I may refer my hearers to the report which is published in *Journal* No. 1776, that of December 3d of last year. I will not weary you by reiterating what I then advanced. I must, however, make reference to the action of the Lunacy Commissioners. Some twenty-three years ago, an attack of dysentery arose in the Cumberland and Westmoreland Asylum, of which the resident medical officer thought it possible for the sewage-farm to have been the cause. "The facts show," says Dr. Tidy, "that sewage emanations from sewage-farms may be the cause of dysentery, diarrhœa, and typhoid fever." I beg leave to differ *in toto* from Dr. Tidy upon this point; the facts showed nothing of the kind, except the notion of *post hoc, ergo propter hoc*. There was not a single point which really proved the sequence as cause and effect. And although sewage utilization by means of irrigation, sometimes in most insanitary and objectionable ways, as far as the senses are concerned, has been practised in hundreds of places all over the kingdom, no such alliance has ever been proved to exist, and no such result has been satisfactorily brought to the notice of any Court of Law, or to that of the Local Government Board at Whitehall. For this opinion I have the authority of Mr. Arnold Taylor, who supported the statement when I made it before him last year, when he was holding an official inquiry at Croydon, as to an extension of the Norwood farm.

In 1884, the Commissioners in Lunacy issued instructions to the managers of lunatic asylums, "As practical suggestions to those authorities in reference to sewerage, drainage, water-supply and sewage irrigation." There are no other directions as to disposal of sewage except by irrigation, in which the Commissioners, following the advice of a very deservedly distinguished engineer, Sir Robert Rawlinson, have dwelt with the subject on a practical as well as scientific basis. I commend the directions in those instructions to the attention of those interested in the welfare of the country, and would suggest that at any rate the Lunacy Commissioners have no belief in Dr. Tidy's theory that sewage emanations from sewage-farms cause dysentery, diarrhœa and typhoid fever, and they have abundant evidence to rely upon.

Nearly all the lunatic asylums and other establishments for large masses of people which have been built in recent years, such as Sir Richard Cross's asylums for the imbecile, utilize their sewage in the manner indicated by the Lunacy Commissioners; in some cases using the liquid matter in close proximity to their airing grounds without a single proof of mischief from the result. It would be interesting to collect (if time would allow of it) the extracts from the reports of the managers of these institutions to their constituents at Quarter Sessions in different parts of the country, in which it is universally stated that the results are "highly satisfactory." Why Dr. Tidy should ignore this evidence and rest his case upon the shadowy opinions of the *post hoc, ergo propter hoc*, passes my comprehension. I have a return before me from Catherham asylum, which has 2,000 inmates. The report states "that they have no permanent pasture;

[2] A paper read before the Society of Arts by Alfred Carpenter, M. D., M. R. C. P., London, and published in the *Journal of the Society of Arts*. Continued from page 140, No. 586.

that 126 acres are cultivated as arable land, or laid down in rye grass as required. The rye grass plots allow of recreation for the patients when such is needed."

Dr. Tidy likens sewage-farms to the fens of Lincolnshire and the rice fields of China. The mischief arising in fenny districts is caused by stagnation; it is capable of removal in the larger part; nay, it is removed. The fens are the same districts now as they were before the stagnant water was removed; dysentery is almost unknown there. They have the same contingencies minus stagnation, and they are as healthy, if they are drained, as any other parts of the kingdom. If there is stagnation upon a sewage-farm there is no financial result, and then there might be such conditions as is described, but such a state is no part of sewage-farm cultivation. Dr. Tidy sums up his denunciations of sewage-farming, on page 1150 of our *Journal*, in a series of charges, most of which counteract each other. As, for instance, that "an untrained observer," such are his words, can easily form a conclusion "that conditions vary;" surely every agriculturist knows that, and knows also that he must prepare his land accordingly. "Inequality of purification," "uncertainty of action," must be met by alteration of arrangement. If there is heavy rain, you must increase your area under sewage for the time being, or arrange to exclude the rainfall. It must be passed over a double set of plots, one after the other. The first being rye grass, or possibly arable, the second may be meadow. None of the conditions described by Dr. Tidy are parts of good sewage-farming; his ague, his dysentery, and his diarrhœa, exist only in his active brain, for there is not a particle of reliable evidence to connect them even with sewage-farm mismanagement, let alone the correct way of dealing with the matter.

The remark as to the pollution of the subsoil water, which is possible, is also as pertinent as that which might be applied to railway management. If they do not exercise proper care, life will be lost; but the law requires proper care, and the loss of life is almost *nil*.

Let me now refer to the remarks upon the distribution of the ova of the entozoa by sewage-farms. I mentioned my correspondence with Dr. Cobbold on the occasion when I addressed the Society in the discussion upon Dr. Tidy's paper. The occasion arose in this way. I wrote to him, inviting him to a breakfast upon the farm upon sewage-grown produce in 1875. A family bereavement at that time prevented Dr. Cobbold's acceptance of my invitation. In his reply, he says, "I have been obliged to put a check, and to modify my views, upon the subject of sewage, which I formerly displayed, on purely scientific grounds."

Some time after that, a herd of beasts which had been fed for two years upon sewage produce on the sewage-farm were in process of slaughtering by a carcass butcher, and I invited Dr. Cobbold to witness the process, and inspect for himself the bodies of the animals as they were killed, as well as those which had been cut up for two days. He was not well, and excused himself from making the inspection, stating at the same time that he had modified his opinions, and become quite convinced that the view he had held, as to the possible propagation of tapeworm eggs, and the distribution of hydatids, or of the cysticerci, were not likely to arise in beasts fed on sewage produce. I have never seen hydatids in animals fed at Beddington. I believe they are not found at Birmingham. Thousands of animals have been fed upon these two farms, and used as food, and it would have been impossible for the existence of such a result to have escaped the observation of the lynx-eyed observers who are always at hand to decry the results of sewage-farming. I do not deny the possibility of such a result, but I think it highly improbable, because the conditions under which the ova of human parasites continue to be propagated, do not hold in the method under which sewage ought to be distributed. If Dr. Tidy could produce an animal infected as he suggests, it would not be an argument against sewage-farming, but it would be grounds for serious charges against the managers of the farm upon which it took place, in allowing cattle to go upon recently sewaged areas. It is impossible to suppose that the ova of creatures which only propagate themselves in the human juices, and at a temperature of 98.5, could retain their vitality in the sewage, and upon the soil for a fortnight under the circumstances of a deprivation of moisture and exposure to light and air that must happen to them if distributed by broad irrigation. I believe the ova presented to the radicles of rye grass are as efficiently digested by that plant as the little fly is by the *Dionea muscipula*, or the ova of the dead frog by the amœba in the wayside ditch, or the particle of meat which may be caught by the tentacles of the sea anemone in a seaside pool.

Dr. Tidy says, that as regards the disease produced by the *Trichina spiralis* "no doubt the danger is constant, but sewage irrigation would render it an affair of certainty." How Dr. Tidy could pen such a baseless statement passes my comprehension, for the produce of more than one hundred irrigated areas are utilized as food at this moment. I have never met with a case connected in any way with sewage-farming, and I ask Dr. Tidy to produce the series which ought to be forthcoming in support of such a statement.

Dr. Tidy's conclusions that to achieve commercial success you must abandon sanitary considerations, are shown by my proofs to be utterly untenable. I contend that financial or commercial success can only follow when sanitary considerations are strictly attended to. Financial loss goes with non-attention both to letter and spirit of sanitary law.

Let sanitary law be looked after, let the local authority do its duty in dismissing sewage as rapidly as possible from within the borders of the town, so that all such may be on the farm within six hours. Let the authority keep out from the sewers the rainfall, except such as falls upon paved streets, courts and alleys. Let them provide the land which is required for the purpose, and not only will the sanitary result be highly satisfactory, but the financial result will be satisfactory too. I do not mean to assert that a sewage-farm can meet the engineering charges which may be necessary to get the sewage upon the land; I do not mean to assert that a sewage-farm can pay a rent sufficient to cover interest and principal when so-called building-ground has to be taken for the purpose. Such charges must be borne by the locality providing the sewage. There is, however, this certainty about it, that the dearer the land which is taken, the greater and the denser will be the population for which it has to be provided. The higher the rateable value of the district, the more able will it be to bear the consequent charges, which in no case, if common honesty and common sense be used, ever need be more than a quarterly rate of 1*d.* in the £, or 2*d.* per half year. This is about the rate which towns may have to pay to have their sewage utilized, and themselves freed from its evil consequences, if it be retained in their midst. In addition to this charge, they must also pay the requisite engineering charges for the production of sewers, which shall not be sewers of deposit, or deliver stinking sewage at their outfall. The denser the population, and the higher the value of land, the greater will be the demand for milk, cabbages, and meat in that locality, and the more certain the market, therefore, for the produce raised on the farm. Whilst as to the fund sunk in the production of the works, it will not be lost, but will be a fund which will be the evidence of wealth among the people who advance the money, of a much more satisfactory character than is the wealth which the French people possess in consequence of the occupation of Paris by the Prussians in the last war, and no place would be more enriched by such a proceeding than the great metropolis itself.

It may be pertinently asked, if the conclusions I have arrived at are so satisfactory, why does not sewage-farming become more general. Let me give you the experience of the Borough of Blackburn. The corporation of the borough triumphed over immense engineering difficulties, and obtained the land required for the purpose. They could not agree with the owner; they took it, therefore, by arbitration, though it was only agricultural land in its strict sense, 380 acres of land, bringing in at most £580 a year. They were compelled to pay seventy-nine years' purchase for that land, whilst the cost of the arbitration amounted to the enormous sum of £13,500. This result was enough to frighten any corporation from attempting to obtain land for such purposes again, and since that time very few attempts have been made to do so. A greater legal robbery was never perpetrated, or a more obvious case of people being made to pay through the nose for what they had a perfect right to take at a fair agricultural value. Sewage-farming is very heavily handicapped; it is opposed by many of the chemists who find it to their interest to support a chemical side of the question; it is opposed by all interested in companies for the sale of patent manures, and of those interested in the speculation which belongs to shares; it is opposed by all who are likely to get promotion-money for other schemes, or to be called as witnesses by parties interested in raising the value of the land proposed to be taken. It has no supporters except those who follow sanitary work for the sanitary work's sake. The Blackburn corporation are, however, deserving of the greatest praise; They have 510 acres of land, for some of which the arbitrator made them pay far beyond the amount claimed even by the owner. In some of it there is a difference of 200 feet in the level. Their engineering and financial difficulties were immense, but taking their two farms together, there is a gain of £300 a year. With such a result before a corporation or a local board, and the difficulty which the Upper Thames Valley authorities found in their efforts to get land, it is not surprising that they hesitate to commit themselves to sewage-farming, but continue to flounder about in chemical-works and precipitation-schemes. The law as to the powers of a local authority to take possession of land for public purposes requires to be seriously altered before it is likely that such schemes will be promoted by corporations, unless by agreement as to price with the land owner.

As I have mentioned, in the years 1876 and 1877 the Society of Arts organized a series of meetings to discuss the sewage question. At both those meetings reports were presented as to the custom followed in all the large towns of the kingdom. In thirty-eight cases the sewage had been, or was about to be dealt with by means of irrigation. I have written to the authorities in all those towns, asking them to give me a few lines upon the present state of the case; whether irrigation is still practised, and with what success, and if not, why not? Appended are the answers I have received from thirty-four of those towns, and I return my thanks to the town-clerks and engineers who so kindly responded to my application.

In thirty out of thirty-eight the answer is a decisively satisfactory one; in six there is no reply, though I know personally that in four the process is satisfactorily continued. No injunctions have been suggested except in one case (Kidderminster) in which damages are claimed. In one small place (Hoole) the sewage now goes into the Chester sewers, and in another (Oswestry) irrigation has been discontinued, because the site was inapplicable for the purpose. There is no hesitation as to the result sanitarily, though nearly all deplore the fall of agricultural prices, and fail to obtain the financial result

which they had anticipated. The reasons for this are manifest either in the nature of the works, the surcharge with expenses they ought not to bear, or the gigantic faults made in the original conception of the scheme. But the broad fact is still patent that sewage can produce a certain result if it be dealt with properly, and no town is justified in allowing that 5*s*. per head to be recklessly destroyed, when, by reason of Continental contingencies, it might make all the difference between famine and surrender to our national enemies, or to a triumphant result in a terrible contest.

Report upon present practice of Sewage Utilization in those towns in which Sewage Irrigation was practised in the year 1877, *as then reported to the Society of Arts; in alphabetical order.*

Aberdeen, 1876.— Forty-four acres of land irrigated for the past six years with good results. — Mr. Goodall, the town clerk, now reports that the system is still in operation; it is only for the third part of the city, and only during a portion of the year, just as in 1876. He is informed that the effluent water is comparatively pure.

Banbury, 1876. — Sewage pumped to farm of 138 acres. — Mr. T. Pain, clerk to the Local Board, writes "Irrigation is still followed, the system is found to be very satisfactory; there is no complaint, either with regard to the character of the effluent, nor of any nuisance arising from smell."

Bedford, 1876. — Sewage pumped to 10 acres of land. — Mr. J. H. Collet writes: "The system is still carried on with great success, as far as the sewage is concerned, but by reason of excessive rents, and the low price of produce, it is not paying at the present time; we see very little of the effluent, having very few acres of the land underdrained. Our sewage is passed through the soil, which is of a very porous character."

Blackburn, 1876.— Irrigation practised for three years.— Mr. Squire, the town clerk, writes that the Corporation have about 400 acres under irrigation, and that the process is commercially successful. The facts mentioned in the text of my paper are taken from an excellent *résumé* of the works prepared by Mr. J. B. KcCallum, the Borough engineer, which shows what skill can effect.

Birmingham, 1876. — Twelve million gallons daily treated with lime at Saltley, and the sewage then utilized upon land by irrigation. — Mr. W. S. Till, engineer to the Board, states, in a recently published paper, that the necessity for lime treatment arises from the nature of the manufacturers of Birmingham. That they have 1,227 acres available for sewage disposal. That 16,000,000 gallons are daily utilized on the farm. The Corporation realized £4,406 last year by the sale of milk. The income for the sale of stock and plant was £22,728; whilst the payments which included rates, taxes, and purchase of stock (£7,760), amounted to £22,822. I visited this farm last year and was conducted over it by Alderman Avory. The condition of the stock was everything that could be desired as to health and nutrition; there was an entire absence of any of those conditions suggested by Dr. Tidy. The manner in which it is worked as a milk-producing farm is highly creditable to the managers. But there are cultivations which do not belong to a sewage-farm. It is worthy of imitation, as showing what may be done in stock-keeping and milk-producing. Only 100 acres are laid down with rye grass. There can be no doubt as to the satisfactory character of the effluent, and also the absence of nuisance from the farm itself, though the quality of sludge is something enormous.

Cheltenham, 1876. — Irrigation on grass land carried on for about ten years. — Mr. Bridge, the town clerk, writes: "Since the date of last report to the Society of Arts, we have purchased 230 acres of land three miles out of the town. The effluent is fairly clear, and we have no complaints. At one of the farms it is passed through some filter-beds before being passed into the stream. We let the farms, and we sell dressings of the fluid sewage to the farms on the line of outfall sewers. The income is about £1,000 a year. We have not completed one of the farms, but when the whole is let we expect to increase the rental. The outlay, including management, interest, and repayment of loan, amounts to about £2,200 a year. A penny in the £ produces £900, consequently the net cost of the disposal of our sewage is about 1½*d*. in the £ on the rateable value, this, it being understood, includes interest on the purchase-money of the farms, which cost us £22,000, and the annual repayment of principal."

Chorley, 1876.— Five hundred thousand gallons per day utilized on sewage-farm, but report says pail-system found (?) best in this locality in respect of cleanliness and utilization. — Mr. Jackson, the town clerk, now writes: "We have still a sewage-farm for the utilization of sewage, which is, upon the whole, from a sanitary point of view, quite satisfactory, but the subsoil of the land is clay, and the effluent not so pure as it would otherwise be. Pecuniarily, the farm is not a success, the loss annually being about £200 or £300 a year. This is attributable, perhaps, here rather to local causes than to the faults of the system."

Croydon, 1876. — Irrigation for the past sixteen years. Net cost in 1875 equal to 1½*d*. in the £ rate, including rental of 360 acres of land at £10 an acre. — Now (1887) the corporation have more than 700 acres of land which are used for irrigation. It has been purchased at an average cost of more than £300 an acre, and since the purchase a great expenditure has been incurred in building cottages for workmen, and erecting proper farm buildings, so that the old system of starving the farm need not be continued. It had been the custom to avoid the purchase of stock; to pay into current account the sums received for the sale of that which was on the farm, so as to reduce current rate, but not to provide for the consumption of the produce next year. The result was, as I have stated in my paper, the destruction of more than 200 acres of rye-grass land, whilst new fields were not prepared. In 1877 and 1878 the receipts from produce were £7,162 and £7,585 respectively, but in 1880 it sank to £4,088 and in 1881 to £3,891, entirely from mismanagement by irresponsible farm committees, who declined to continue the plan of producing milk and using up produce by their own stock. The receipts from sale of milk dropped from £2,320 to £819. At this juncture a wise and far-sighted milk farmer erected cow-houses for 300 cows upon a part of the farm at Beddington, and entered into an agreement with the Corporation for the supply of grass, and raised the income to the Corporation, for the sale of grass, to the figure it had occupied in 1879, viz., £2,300. The proprietor of those cow-sheds has, at this moment, one of the finest herds of cattle to be found in any part of the country, producing an abundance of rich milk which has a very ready sale, and his cattle will (like those at Birmingham) be able to hold their own for weight, personal appearance, sleekness, with any herd in the kingdom, for they are carefully groomed and kept, as cattle ought to be, as clean as a stud of horses. He is doing what the Croydon Corporation were unable to do, to the great advantage of the neighborhood, and I have not the least doubt also, to his own pecuniary benefit. I wish him most perfect success. The income from the farm, during the year ending Lady-day, 1886, amounted to £9,181: the expenditure to £5,101. I am unable to say how the valuation of the live and dead stock upon the farm stands, as it is not included in the published accounts, but I have reason to believe that it is increased and not diminished. I would, however, remark that it is utterly impossible to farm a large property, like that which is in the hands of the Corporation, unless there is stock upon the land to utilize the produce, and 700 acres ought to have a valuation of at least £14,000, to do justice to the work which has to be done. The larger the stock with which the managers have to work, the better the chance of a good pecuniary result. This is seen in the fact that, whereas the farm ought and could, with proper management, now produce £15,000 a year, there has been only obtained £9,000. The working-expenses have, however, been all met, and £4,000 forthcoming towards the payment of interest and principal upon the purchase money; and somewhat less than a 2*d*. rate enables the locality to deal with its sewage without fouling the rivers of the district. As regards its sanitary effect upon the locality, in 1881 I read a paper before the International Medical Congress in London, based upon the experiences of the Croydon sewage-farm. The nine propositions which I then submitted, and which are embodied in their "Transactions," have never been controverted. I will now add the vital statistics of the parish of Beddington and the hamlet of Wallington, in which the farm is situated, and which takes up about one-seventh of its area.

Year.	Population,	Rateable value.
1861	1,557	£11,700
1871	2,874	20,671
1881	5,492	42,450
1886	6,000	46,520

The birth-rate has been gradually rising, and the death-rate gradually falling, during the whole of the time. From the above figures it will be seen that the proximity of a large sewage-farm has not prevented the steady increase in a given neighborhood. There has been steady increase in population, and rise in rateable value of the parish, from 1,557 persons and £11,700 rateable value when the farm was first started, to over 6,000 persons and a value of £46,520 in 1886. Where, then, is Dr. Tidy's idea of depreciated value, increased unhealthiness, and prevalence of diarrhœa, dysentery, and typhoid fever. Surely, land upon which sewage has been utilized by irrigation for more than thirty years, would show the effects, if it was injurious, upon the 6,000 well-to-do persons who have come within a mile of its borders since it has been established, the area of the farm taking up one-seventh of the whole parish. As regards the analyses of effluent-water which have been occasionally made, they have, as far as I know, always been sufficiently pure to go into the Thames, without the least chance of evil to the fish of the Wandle or the human beings on its borders. I am not advocating the theory that effluent is proper water to drink. I have always urged that it is not intended for that purpose, but it is safe where the effluent from certain precipitation processes is not. It contains excess of chlorine, and when applied too long to one plot, there will be an escape of some of the nitrogen. It is a fault of management, and not a fault of the system. Dr. Tidy does not deny the capacity of soil and vegetation to purify sewage; that which can be done by one or the other can always be done by both if a proper supervision is exercised.

Doncaster, 1877. — Sewage pumped upon farm three miles away. — Mr. Shirley, the town clerk, writes: "The borough possesses 263 acres, laid out, in 1873, by Mr. B. S. Brundell. It was leased in 1874 to the brother of the engineer, at an annual rent of £812. The lease expiring this 2d of February, the Corporation advertised for tenders, and finally let the farm at an annual rate of £550, with 15 acres of additional pasture, the then tenant only offering £500. The farm is about two miles from Doncaster, and we have never heard of the smallest complaint. We have a population of about 25,000 people."

Epsom, 1877. — About three-fourths of sewage dealt with by subsidence and irrigation upon 60 acres of land rented by the Board.

Windsor and Eton, 1876. — Sewage dealt with by irrigation on separate system. Has been in operation for six years on 50 acres. — Mr. Whitehouse, the surveyor, writes: "We have carried on the irrigation system with great success since 1870 to the present day. The town and college are drained upon the separate system, to the total exclusion of storm and surface water. There is no complaint from any one living near to the farm. The farm was laid out by the late Mr. Menzies."

Harrogate, 1876. — Irrigation in use seven years for portion of locality. — Mr. W. H. Wyles writes: "We have a sewage-farm of 310 acres, over which the sewage has flowed for a good many years, in some parts for nearly twenty. There is no pumping. The natural slopes offer easy gradients. The effluent passes into the brook sufficiently pure to satisfy keen and hostile observers. Our only practical difficulty arises from the nature of the soil. This is, then, with a clay subsoil which quickly hardens in winter, and cracks in summer, so that we have to exercise the greatest care. Still the results to us are, on the whole, satisfactory."

Hoole, 1876. — Irrigation for seven years past; population 1,720. — Mr. Weaver, the clerk to Local Board, writes that complaints were made against the filtering-tanks which the Local Board used before allowing the sewage to go on to the land in 1882, and since that time their sewage has gone into the Chester outfall sewer, and the practice discontinued.

Kendal, 1876. — Downward filtration and irrigation for portion of the sewage. — Mr. Bolton, the town clerk, writes: "Mr. Alderman Nillhson gives me notes. Downward intermittent filtration is carried on here with the same success which has attended it during the past ten years. We have about 9 acres of under-drained land, cropped in the following manner: 2½ acres rye grass, and 6½ acres producing a great variety of vegetables of good quality in about 5 feet ridges; carrots last year, over 14 tons to the acre. Some of the beds were afflicted with grub two years ago; we found that a dressing of gas-lime was a preventive. We have four acres of grass-land, over which we flow the sewage about four times a year. The remainder, about 8½ acres, is brought into a high state of cultivation by applying the sediment of the filtering-tanks, and lets at £5 per acre. The acres can be worked by two men and one horse, and the produce leaves a profit, after payment of the cost of working, of £60 a year. The effluent water of the outlet is always clear. The drawback is having too much subsoil-water, amounting to 1,000,000 gallons a day, to deal with."

Kidderminster, 1876. — Sewage dealt with by irrigation. — Mr. James Morton, the town clerk, writes: "Irrigation still carried on upon the corporation farm in the same manner as in 1876. The effluent is perfectly clear and without smell, as I can personally testify. Mr. Arthur Coomber, the borough engineer, says that the effluent is perfectly clear and in every way satisfactory. The farm is, at the present time, in a highly satisfactory condition. Mr. Morton, however, informs me that a neighboring owner is claiming damages for depreciation, which will have to be settled by an appeal to a law court."

Leamington, 1876. — Sewage used upon a farm belonging to the Earl of Warwick. — The town clerk now writes that irrigation is still carried out upon Lord Warwick's farm. During the last sixteen years I have never heard a complaint arising from the effluent water. The Corporation have just made a fresh arrangement with Lord Warwick for continuing the agreement, by which he receives the sewage for a further period of thirty years.

Leek, 1876. — Portion dealt with by irrigation. It has been found the best method of disposing of water-carried sewage; 450,000 gallons every twenty-four hours. — Mr. K. Farrow writes: "In 1860 a covenant was entered into with certain land owners to use the sewage by irrigation. All went well for many years, but some extensive silk dye-works and print-works were established, which added about 200,000 gallons of waste water to the sewage, that became so diluted as to be of little value for irrigation, and consequently the whole found its way into the river. The dyers have now constructed a separate sewer for the waste dye water, and the sewage is restored to its usual state. We shall now be able to go on satisfactorily again. No payment is made by the land-owners for the sewage."

Longton, 1876. — Sewage used by irrigation upon land belonging to the Duke of Sutherland. The Duke to pay £500 a year for it. — Mr. Hawley, the town clerk, writes: "I have no means of knowing what result the character of the effluent has been attained, but I have never heard of any complaint. The same contract exists as in 1876."

Malvern, 1876. — Intended to adopt the intermittent downward filtration scheme and irrigation proper, used for irrigation in 1877.— Mr. Jno. Palmer, the Town Surveyor, writes: "The system has been in operation since 1882, viz., broad irrigation and intermittent downward filtration. It is working satisfactorily, with a good effluent. The total area under cultivation is about thirty-five acres, eleven acres of which is under the intermittent filtration, and is divided into eleven sections, two and one-half acres of osiers, and the remainder broad irrigation. We have a farmstead; nearly the whole of the produce is consumed by the stock. There is a ready sale for the osiers, and all the crops during the past year have been excellent. We have separated the storm-water from the sewage, except that from the tops of houses and yards. If laid out with our present experience, we could materially improve the construction, and get a much higher standard of purity."

Norwich, 1876. — Sewage pumped to land 150 feet above, and 24 miles from the station. Irrigation has been in use for four years. Three million gallons every 24 hours. — Mr. Marshall, the city engineer, states that the farm has been successful in purifying the sewage, but as a commercial speculation it has not been so; the sewage is poor, but few water-closets in the city, and the sewage almost all spring rain-water. The farm is let out to a good tenant, who works it as a dairy-farm. We lose about £100 a year on the rent. I think it does fairly well.

Oxford, 1877. — Sewage will be utilized by irrigation, being pumped to a farm of 320 acres; is being laid out. — Mr. W. H. White, the engineer to the Oxford Local Board, writes: "Sewage was pumped to the land first in 1880. We get a satisfactory effluent, and there are no complaints of the farm from adjoining occupiers. Roughly, the financial result of our operations is that the produce of the farm rather more than pays the actual working expenses."

Reigate, 1876. — Sewage utilized on farm. — Dr. Grace, the Town Clerk, writes: "Utilization of sewage by irrigation has been carried on in this borough for the past 18 years. To say that no complaint as to the character of the effluent-water would be to say rather too much; but the complaints ceased when the council removed some agricultural drains into which the sewage-matter penetrated, and escaped without being duly purified, and the complaints have not since been audible."

Stoke-upon-Trent, 1876. — Sewage-irrigation proposed but not carried out. — Mr. W. Bagnall, the Town Clerk, writes: "The sewage is now dealt with by means of irrigation and downward precipitation on a small farm of 61 acres. The effluent is very satisfactory, the farm is let at a low rental of £120 a year."

Warwick, 1876. — Sewage dealt with by irrigation pumped upon 135 acres of stiff clay. Mr. Greenway, the Town Clerk, writes: "The Town Council have not altered their system of sewage utilization by irrigation, which was adopted many years ago. They believe it to be the best mode of dealing with this difficult subject. I must, at the same time, admit that the effluent is not at all so satisfactory as could be wished, but an increased filtering area, which has been recently constructed, will remove all difficulty in this direction. Financially, I cannot speak so hopefully; the result has been a heavy loss to the town."

Winchester, 1877. — A scheme is being promoted for pumping sewage to farm by lift of 100 feet, to be then treated by irrigation. Mr. Walter Bailey, the Town Clerk, writes: "The sewage of this city is utilized by means of irrigation with complete success. The land consists of 40 acres, a mile from the city. The sewage is conveyed by gravitation to the pumping-station, from whence it is raised by steam-pump to the land, 150 feet at the highest point. No nuisance is occasioned. There is no effluent-water to be dealt with. The system has been in operation about eight years, and gives great satisfaction. Apart from the pumping expenses, the farm is carried on at a profit, excluding the purchase of the land."

Wolverhampton, 1877. — Sewage dealt with by irrigation upon farm of 300 acres, purchased for £32,000. Mr. Berrington, the borough engineer, writes: "We have a farm of 300 acres, but the peculiar character of the sewage, being irony, coupled with the storm-water, has ruined it. If we had plenty of land, irrigation would turn out a satisfactory effluent. Notwithstanding that, we have a very small trout-stream into which we have to pour our effluent. My opinion is that while we have a sewage containing sometimes 62 grains of iron per gallon, we shall never turn out a safe effluent, for iron must get on to the land, and ruin it, or into the effluent, and spoil it."

Wrexham, 1877. — Here is a sewage-farm of 80 acres in lease to Corporation, under-let to Colonel Jones. House-water complained of by tenant. Colonel Jones now writes: "There are no complaints as to the effluent from the farm, which is carefully watched by the Corporation of Chester, from a natural anxiety about their water-supply, derived from the River Dee, below the confluence with the brook, which receives all the drainage-water from this farm. Of course, the fall in prices of agricultural produce has materially affected our finances. I still pay in rent, rates, and taxes nearly £5 per acre. I still keep accurate accounts, such as were published for the first seven years up to the date of my receiving the £100 prize in 1879, and keep my head above water. You will find a full report of everything in the *Journal of the Royal Agricultural Society*, Part 1, No. 31, 1880, and in pamphlet published 1885, by Potter, Wrexham, '*Will a Sewage-Farm Pay.*'"

COMMUNICATIONS

REPRODUCING EUROPEAN WOODWORK IN AMERICA.

SAN DIEGO, CALIFORNIA.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — It is a little surprising that while the timber architecture of this country shows a constant progress towards the picturesqueness and variety which characterized that of the Middle Ages, which, in many cases, evidently form the *motif*, there is always a certain flimsiness about modern productions that contrasts very strongly with the massive and solid look of ancient erections.

While the old timber buildings of England, France and Germany are finished off with carvings of the greatest power and delicacy, there is always an aspect of dignity and repose which is entirely lacking in American dwellings, though in many instances our carvings are of the highest merit.

This should not be so. Timber here is as good and much more easily worked and procured than it ever was in Europe. A man should be as pleased to have a house that will last for four or five hundred years here as there.

I should like to see some houses built in America in exact *facsimile* of old European dwellings. I do not believe in slavish imitation, but a few houses such as these would help to get us out of our cardboard style, and then we could graft modern improvements on the ancient plan without sacrificing a substantial construction and appearance.

As far as details and ornamentation go, we cannot study too closely European patterns. Besides the exquisite grace and elegance, carving like that at Abbeville, Bourges, Lisieux, Hildesheim, Brunswick, Chester and Canterbury would impart to our buildings, such reproduction would help to preserve what otherwise must be lost. The destruction of masterpieces of timber-construction in Europe is appalling. Every year witnesses the levelling of hundreds of grand old manor-houses, town mansions and country cottages, without, in many cases, any record whatever. A few bits of carved wood are occasionally saved from the burning, but generally, only to be as effectually lost in private collections.

Will not American architects perpetuate and immortalize some of these priceless gems of art in modern villas, or even in business premises? Yours respectfully,

Evacustes A. Phipson.

DEVICE TO PREVENT WATER-BACK EXPLOSIONS.

Detroit, March 12, 1887.

To the Editors of the American Architect:—

Dear Sirs,— So much has been said and written about the trouble caused by the bursting and exploding of water-backs that I determined some time ago to overcome this annoyance, if possible, and I think I have succeeded perfectly; at least, I have been granted a patent for the contrivance.

The device is very simple, and consists of an air-chamber made of corrugated sheet-iron, placed inside of the water-back; when the water freezes it will expand .089 of its bulk; and as the compressibility of air exceeds this by far, an air-chamber of, say one by two inches, in an ordinary size water-back, will accomplish the object, and danger of bursting or exploding is averted, either from the expansion of ice or pressure of steam; to make sure, I have added a device in the shape of a plug placed in the top of the water-back, held in its place by a spring, which will allow the plug to raise up under a certain pressure of steam, thus acting as a safety-valve; when, then, the connections between the water-back and boiler are made with lead pipe, instead of iron pipe, all danger of bursting or exploding is averted.

I send you this, as I think it my duty to make it known to the public. Yours respectfully, H. E., *Architect.*

NOTES AND CLIPPINGS

The Area protected by a Lightning-rod.— Herr Schiller, a well-known German architect, reports some facts which are of interest as indicating the radius of the circle of protection of good lightning-rods. On June 17 last, at the village of Mottingen, lightning struck a pear tree 33 feet high. On one side, 115 feet away, was a school-house with a rod 56 feet high. On the other side was a church, 328 feet away, and having a lightning-rod reaching up 154 feet. Both rods are well placed and had worked well when tested, and the level of the foot of the tree is about the same as that of the two buildings. It is evident, then, if the facts have been accurately reported, that the radius of the circle of protection is not more than twice the height of the rod.— *N. Y. Evening Post.*

Cleaning Stone-work in Large Cities.— The problem of cleaning the sculptured part of large public and private buildings which blacken and discolor so rapidly in our great cities has been carefully investigated in Paris by M. de Leibhabert, who puts his experience on record in the *Annales des Ponts et Chaussées*. He began at a number of masonry docks along the Seine. The black coating which covers the stone completely after a few years of exposure is first covered with a caustic paste consisting of soda and lime, which are mixed until they have the consistency of molasses. A little chloride of lime or perchloride of iron may be added. This paste is allowed to remain on the stone for two or three hours, according to the character of the stone and the state of the atmosphere. When it is washed off the stone is still black, but the coating has now been reduced to a condition in which it can be attacked by acids which before it resisted. After this preliminary operation a workman applies a mixture of sulphuric and hydrochloric acids, which is allowed to act for two or three hours. The mixture of the two acids varies slightly, according to the character of the rock and the inclination of its surface. Another set of men then wash the stone off with a jet of water. The process in Paris costs one-half of what is paid for scraping.

A Yankee Peddler's Cure for a Plague.— I was told a story of a "down-easter's" mode of creating a demand for a supply which, amid all the ingenuities of modern commerce, may fairly claim originality. One of the class called a "hickory-dealer," or seller of wooden-ware, came down to the South in the summer time with a well-laden wagon, but was destined to encounter a sweeping opposition in the yellow fever, which had commenced business about a week previous in such a wholesale way that the only wooden-ware in requisition was a coffin. The ravages of the plague were at this time so dreadful that it will be supposed there was a general tendency to try the most desperate, and absurd expedients to avert it, though many such proved but pioneers to its progress. This the peddler was aware of, so resolved, as regarded his own fortunes, to extract good from evil. Dressing himself as respectably as possible, he mounted his horse and rode up to a printing-office in Williamsburg, where, under an assumed name, he had a hundred bills struck off to this effect:

WANTED—immediately, wooden ware in any quantity, for the fever hospital in Philadelphia, such being found not to convey the infection. By order of the board of health. SETH ADAMS. N. B.—All persons cautioned how they use crockery, which is the cause of the plague to thousands.

Fifty of these placards he sent his boy to stick round the streets of a village lying in his road where the fever had begun to show itself. A discovery so important, so simple, and apparently in such close connection with a remedy, created an instant sensation. The doom of crockery was pronounced. Jugs, bowles, basins, teapots, and other utensils most esteemed or necessary were hurled out of the windows in showers. No grandmother's gift, no ancestor's relic survived this fall of china; the streets soon looked like a pottery after an earthquake About noon, when the work of destruction was at its height, a wagon made its way into the village with a man vociferating with all the power of his lungs "wooden-ware!" His arrival was hailed as a godsend; a crowd collected around him, as to a magician who brought a talisman, and in less than two hours his plague-averting platters were all disposed of at exorbitant prices.— *Boston Herald.*

TRADE SURVEYS

The clearing-house returns exhibit a slight falling-off in the volume of business. Railroad-returns are encouraging to investors, stock-holders, and to all the large interests concerned in the production of material for railroad construction. The general trade conditions remain favorable. Temporary influences are restricting trade. Permanent influences beneath them will bring demand up again to its strongest limits. The assured requirements of the country will engage every energy at command, and all that are being harnessed for early service. The salient features are these: Business has been checked by the change from an irrational to a rational basis of railroad management. No doubt the crude legislative efforts will be liberally supplemented by future Congresses as the requirements are made manifest by practical experience. The money-supply is equal to demand, and at present distribution to borrowers the dangerous point will not be reached this season. Even experienced financiers cannot tell when or how the volume of money may be decreased or increased. The presumption is the safest that the supply will decline, because of the increasing demands. Foreign money centres may be compelled to equalize exchanges in coin and thus protect us against the possible consequences of the depletion in progress. Borrowers are quick to return loans as soon as they have performed the services desired. Large outflows of capital are reported one month to the West to be followed next month by a return flow. The volume permanently invested in the West and South is steadily increasing, and fortunately is being invested on a basis, most of it, at least, of actual value. It is pleasing to note that real-estate values are preserved at a legitimate level. In Northern Alabama, and at one or two points in Kansas, a fever of speculation is apparent, but it affects limited areas. The closest investigation of the tendencies underlying the business world fails to unearth any really dangerous element or factor. The government has shown itself equal to the work of asserting its supremacy over railroad property. It has taken steps showing itself to be the willing servant of intelligent public opinion. Investors have, therefore, an additional evidence furnished them that investments are safe, that no reactionary or experimental legislation is probable, and that business ethics and standards of action will guide our law-makers.

The latest advices from manufacturers, railroad-builders, architects, and real-estate operators exhibit a steady growth of enterprise. That ten to twelve thousand miles of main track will be laid this year is evident from the fact that already 1,500,000 tons of steel rails have been contracted for, to be delivered this year, sufficient to lay over 16,000 miles of track. The reserve supply of 450,000 tons at least. Contracts for bridge work will be placed during the next three weeks which will furnish work enough for three month's production of our structural-iron making capacity. Contracts are now being placed for all manner of building-material to be used in the construction of mills, furnaces, factories, banks, warehouses and dwellings. The outside public world compare the volume of business now under passage to fairy tales, were it possible to picture it. Not less than 25 large blast-furnaces are to be built. The lumber-interests will be benefited, by the addition this season, of over 100 large saw-mills. The coal, ore, gold, silver, and copper mining interests will be strengthened by the addition of machinery sufficient to add 25 per cent additional facilities. Prices exhibit firmness and nothing more. Crude textile material is in abundant supply. Fuel supplies are guarded by combinations which will have but little influence in repressing healthy competition. The manufacturers of machinery have contracts in hand which forbid the possibility of dulness until after midsummer. The locomotive-makers and car-builders say so, too, and some of them are to-day soliciting a large labor supply. Small machinery is relatively in greater demand, because of the steady multiplication of petty industries all over the country. Pig-iron production is closely approximating 140,000 tons per week or 7,000,000 tons per year, while steel-rail production after this year will be equal as to capacity to 20,000 miles per year. The increase of motive-power and rolling-stock, or the increase of mechanical energy in the aggregate, can only be guessed at from figures like these. The builders can, therefore, take additional courage. The progress the country is making is not on borrowed capital. The percentage of borrowed money to actual wealth created is very small, and is growing less. Hence, even should our over-energy leap too far forward, the relapse will be so much the shorter because the nation will have no enormous debts to pay.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. No. 587.

APRIL 2, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

MR. HENRY R. TOWNE, the President of the Yale and Towne Manufacturing Company, writes to the *Sanitary Engineer*, mentioning the advantage which he has found in the use of free steam in moistening the air of his house in winter. It is needless to say that the observations of a man like Mr. Towne would always be interesting, and in this case they have a considerable practical importance. The house in question is heated by steam, on the indirect plan, fresh air from the outside being brought in contact with box coils in the cellar, and thence delivered through pipes and registers into the rooms. Although the usual evaporating-pans and other appliances for communicating moisture to the dry external air were provided, Mr. Towne found that, as shown by the hygrometer, its condition, when delivered in the rooms, was far below the standard of moisture which is recognized as most conducive to health, the percentage of humidity ranging from thirty to forty per cent of saturation, while sixty per cent is considered to be the most wholesome proportion. With the idea of increasing the humidity, Mr. Towne then resorted to extra evaporating-pans, porous cups in front of the registers, and even wet cloths hanging from pans of water, and, by their action, partly of capillarity, and partly of siphonage, extending greatly the area of wet evaporating-surface. All these devices combined, however, as he says, failed to increase the moisture more than from five to ten per cent. Finding these devices inefficient, as well as troublesome, he then had one of the steam coils tapped, so as to admit a small jet of steam directly into the air-box. This at once raised the proportion of moisture so greatly as to convince him that nothing more would be necessary to communicate any desired amount of humidity to the air, and he had two coils arranged with small openings, controlled by valves, for admitting steam, to mix with the warm-air supply to the rooms above. With these it is found perfectly easy to maintain the proportion of moisture at fifty or sixty per cent of saturation during the winter, and the proportion can readily be increased by opening the valves wider, but it is found that a moister atmosphere gives trouble by excessive condensation on the windows.

THIS method of improving the quality of the warm air supplied to rooms is not altogether new. The Walworth Manufacturing Company, of Boston, if we are not mistaken, has long made and sold a valve, with a little condensing-kettle and drip-pipe, for allowing steam to escape in small quantities from coils or radiators, either in direct or indirect heating, for the express purpose of moistening the air which circulates about the radiator, and we think it very probable that similar ones may be obtained of other manufacturers. However they may be arranged, their efficiency is surprising. Not long ago, we were in a house which has a small conservatory opening out of the hall. The floor of the conservatory is about ten feet above the street, and, as it faces the south, and is surrounded on three sides by furnace-heated rooms, and is itself warmed by direct radiation from two small vertical-pipe radiators, standing in it, the air in it would under ordinary circumstances be very dry, far too much so for the health of plants, unless constant syringing were resorted to. In order, however, to counteract the dryness naturally resulting from the conditions, a Walworth valve had been attached to one of the radiators in the conservatory, and kept a thread of vapor always issuing into the air. Nothing could be simpler than this, but its efficacy may be judged by the fact that on the morning when we observed it, although the thermometer inside the conservatory stood at eighty degrees, and that in the adjoining rooms at seventy-five, the thick plate-glass windows between were covered with a copious condensation. It is hardly necessary to say that an atmosphere at eighty degrees, showing a dew-point of seventy-five degrees, contains nearly the utmost amount of humidity which it can receive. All plants would not thrive in so moist an atmosphere, but it suited most of the tropical ones which were in the conservatory, and was at least more generally congenial than the parched air of most conservatories attached to dwelling-houses. How far a similar air would be beneficial to human beings is a disputed point. Most people breathe more freely, and with a certain sense of refreshment, in a very moist air, but in our winters there is perhaps an increased danger of taking cold in going from a moist atmosphere to the keen, dry air out of doors, and we have known it earnestly argued that on this account, in cold weather the air of dwelling-houses should not be allowed to get too moist. We leave the settlement of this point to the sanitarians, nearly all of whom, however, take the opposite view, and will content ourselves by remarking that, as Mr. Towne says, an atmosphere containing sixty per cent of humidity feels as warm as a dry air at a temperature at least five degrees higher. Mr. Towne says that a moist air at seventy degrees is more comfortable than a dry one at eighty. We should not consider either of them comfortable, but would rather say that an air with sixty per cent of moisture at sixty-five degrees of temperature feels as warm as the ordinary air of a furnace-heated house at seventy or seventy-two degrees, and is much pleasanter, and, according to our own experience, more wholesome. It may be well to make the observation that if valves for admitting steam directly to the atmosphere are placed on coils or radiators, the boiler should be well cleaned, and care be taken to supply it with ample quantities of pure water. It should not be forgotten that the jet of free steam is practically a small jet of water from the boiler, which must be often replaced, or the tubes will burn out, and perhaps even explosions ensue; and if the water-supply is impure, or the boiler lined with deposit, the steam will carry with it into the air of the rooms a smell of stewing organic remains, which is anything but agreeable.

WE wish to call attention to the examination of candidates for the Rotch Travelling Scholarship in Architecture, which takes place at the Museum of Fine Arts in Boston, on Thursday morning, April 7, at nine o'clock. As usual, the first examination will be a preliminary one, and candidates will only be required to make on the spot and submit a sketch design, upon a programme to be assigned at the time. The sketch designs will be considered, and the authors of those which appear to the examiners satisfactory will be notified to appear on the eleventh of April, and the two following days, for examination in the history of architecture, in free-hand drawing, construction, perspective, shades and shadows, and French. On the seventh of May the finished drawings of the design indicated by the sketch made a month before must be handed in, accompanied with an accurate perspective; and this will complete the examinations. Certain changes have been made in the arrangement of the examinations since last year. Those relating to construction, history and other topics, instead of being postponed to the end of the month following the preliminary trial, take place four days afterward, so that the candidate may have them off his mind, and be free to develop his design without being distracted by the necessity for keeping up his French or his graphical statics. Another change which concerns the examiners primarily, and the candidates indirectly, is that the history of architecture is to count for twenty points, out of a total of seventy-five for all subjects except design, instead of fifteen points, as heretofore; and French, instead of fifteen points, will now count for only ten. Experience has

shown all these changes to be desirable, and the new arrangement will probably be permanent.

OF the value of the Rotch Scholarship to the profession, and, we might say, to the country, as well as to the candidates, we can only repeat, with more confidence than ever, our high opinion. Since its establishment, the draughtsmen and young architects of Massachusetts have had something to work for worthy of their ambition, and they have not failed to avail themselves of the opportunity. In such an effort all gain, the unsuccessful candidates nearly as much as the successful ones, and the standard of attainment among the younger members of the profession is continually advancing. We can hardly say whether more credit is due to the wisdom of the examiners in selection, or to the excellence of the material offered, but it is certain that the Rotch scholars so far have gained distinction abroad for the profession in America, as well as for themselves. Our readers already know something of the interest which Mr. Blackall's earnestness and ability excited among foreign architects, and the kindness which was everywhere shown him by the profession; and his successor, Mr. Mead, has already gained laurels of a different kind for himself and his brethren. The beautiful sketches in black and white, from his hand, which we have had the pleasure of reproducing so often during the past year, have shown sufficiently his artistic feeling and power of drawing, and he has recently turned his attention to work in color, with extraordinary success. Such of his color sketches as have come to this country have called forth the warmest praises from those who have seen them; and a little exhibition of similar works which he gave recently in London aroused even the *Saturday Review* to words of admiration such as it seldom condescends to bestow upon anything American. Two or three years ago, on the occasion of the publication in Boston of the Architectural Association Sketch-Book, the London professional journals warned their readers that the young American architects had nothing to learn from their transatlantic cousins in the matter of architectural sketching, and that if the latter did not bestir themselves they might find the Americans far in advance of them. So long as Alfred Waterhouse and Ernest George, and a few others, continue to hold brush and pen, we hardly expect to see the champions of England beaten by the best Americans, but there is no one among the younger Englishmen who seems particularly destined to wear Waterhouse's or Norman Shaw's mantle, while the Americans seem, so far as we can judge by the exhibitions, to gain year by year, and out of half a dozen of the more prominent ones, it would be hard to say which is first.

PUBLIC opinion, to judge from the newspapers, is rapidly accumulating against the tyrannical practices imported from the Old World by the leaders of labor organizations, and used so recklessly to maintain their power over the poor and helpless. To relate the instances of almost savage cruelty and treachery on the part of the trades-union leaders would be an endless task, but the accounts begin now to be diversified with an occasional example of the punishment of the Union conspirators against other people's living. A few weeks ago a builder in New York happened to transgress one of the Union rules, by employing some person, or using some materials or apparatus under the Union interdict. A walking delegate thereupon presented himself, and began to talk to the workmen, as a preliminary to calling upon them to pack up their tools and leave the building, when the contractor saw him, and, suspecting what he was about, ordered him off the premises. The walking delegate, nearly stupefied at this insult to his despotic authority over masters and men alike, refused to obey, and the contractor immediately sent for a policeman, who, on his complaint, marched the delegate to the station-house, where he was arraigned and fined ten dollars for illegally interfering with some one else's business. In a subsequent instance another walking delegate, who had begun his exhortations to the workmen employed by a contractor whom the Unions wished to injure, was arrested in the same way, at the contractor's request, and fined fifty dollars by a judge somewhat less amiable than the other. In a third case, an architect was so ill-advised as to take the law into his own hands, and, finding a walking delegate pouring his siren strains into the ears of the men in a building under his charge, immediately proceeded to express his opinion of such conduct by kicking the delegate downstairs and out of the building. The injured magnate consoled himself by procuring a warrant for the architect's arrest on a charge of assault and battery, but the matter was compromised by an apology from the architect, which was good-naturedly accepted by his victim.

EVERY one has heard something of the remarkable substance extracted from coal-tar, which is three hundred times as sweet as sugar, and most persons have probably looked forward with apprehension to the time when this interesting product should be surreptitiously substituted for natural sweetening in the food offered them to eat, with results which they did not care to investigate. It would seem that this time is not very far off, to judge from an article in the German *Sugar Manufacturer's Journal*, which says that an establishment for the production of the artificial saccharine is nearly ready for business in Westerhusen, near Magdeburg. The material produced in the factory is to be used, it is said, for mixing with glucose. One part of the new saccharine, mixed with five hundred parts of glucose, gives a compound as sweet as the beet sugar universally used on the Continent, and at a much smaller price, since glucose can easily be made out of rags, refuse potatoes, or a score of other inexpensive substances, while the other ingredient of the imitated sugar is produced with little difficulty from another cheap material. Naturally enough the persons who have invested their money in beet farms, and costly establishments for extracting pure sugar from the roots, do not like the idea of finding their goods driven out of the market by so shabby a competitor as the starch and tar sugar, but the German manufacturers do not seem to have found any way of defending themselves. The committee appointed to consider the matter did, indeed, resolve to petition the Government to lay a tax on the saccharine, but as the substance can be readily made on a small scale, it is hardly to be expected that the tax can be collected; still less that the manufacture can be stopped. The controversy seems likely to resemble in many points that which has so long raged in this country in regard to oleo-margarine. There appears to be no evidence, in the case of either substance, that it is injurious to health; yet most people prefer to know what they are eating, and it would not, perhaps, be amiss to compel the labelling of packages of glucose sugar, in the way that packages of oleo-margarine are labelled with us.

THE *Deutsche Bauzeitung* describes and illustrates a pretty chandelier for incandescent lights, which has just been placed in the new Stadt Theatre in Halle, and differs completely from the ordinary electric-light chandeliers. Most of these, as every one knows, are modelled after the fashion of gas-fixtures, having, however, the gas globes replaced by objects somewhat resembling the corolla of a gigantic lily, turned downward, and containing the incandescent light-bulb as a sort of pistil. The effect of these is even more stringy and naked than that of a gas-fixture, and it would be hard to change the model without improving it. In the Halle Theatre, the modification is made by forming the body of the chandelier like one of the "sun-burners" so much used in public halls before the introduction of electric-lights, but of a rather ornamental shape, resembling a large vase of prismatic and opalescent glass, attached to the ceiling by its upper rim. The outside of the vase is supported by an enriched framework of bronze, the upper portion of which forms an open net-work for ventilation, and festoons of fruit and flowers, in hammered and chiselled bronze, hang from various portions, alternating with grotesque heads. The interior of the chandelier is well furnished with lamps, which shine through the cut and colored glass, and other lamps, either in the shape of plain bulbs or with a setting of reflecting substances, take the place of fruits in the festoons and garlands, and encircle, like crowns, the grotesque heads. It can easily be imagined that a charming effect can be obtained in this way, and the suggestion is susceptible of infinite variations. We remember seeing at a great flower show in the Metropolitan Opera-House, a fountain surrounded by a sort of hedge of lilies in blossom. Among the flowers were scattered hundreds of tiny incandescent lamps, which received from them at least as much attraction as they gave in return by means of their light, and we imagine that a good many people thought, like ourselves, that the possibilities of the sparkling lamps, as a decoration, might be studied with great advantage by those trained to such work.

EARLY SETTLER MEMORIALS.—VIII.[1]

MEMORIALS TO MAJOR-GENERAL ANTHONY WAYNE.



Monument to Gen. Anthony Wayne, Radnor, Pa.

MAJOR-GENERAL ANTHONY WAYNE, having faithfully performed his duties as sole commissioner of the Government for treating with the Northwestern Indians, and as receiver of the military posts given up by the British, was on his way across the lake from Detroit to Fort Presque Isle, now Erie, Pa., in November, 1796, when he was attacked with the gout, and died December 15, in the Block House of the latter place. According to his wish, he was buried at the foot of the flagstaff, on a high bluff, called Garrison Hill, north of the present Soldiers' Home. His coffin bore his name in gilded brass nails, and was covered with a cloth, and placed in a brick vault made in the clay ground.

In 1809, Colonel Isaac Wayne, his son, came to Presque Isle in a two-wheeled vehicle, to get his father's remains. In company with an old army surgeon, a friend of his father, and some citizens of the town, he started out in search of the grave. For a long time the search was in vain, and only by the chance meeting of a little boy who was tending cattle on the hill, and who pointed out the place, were they able to find it. He found the body in a state of almost perfect preservation, and the clothes and boots were quite undecayed. The latter articles were given to an old soldier, who wore them a long time, in honor of his old general. It being impossible to carry the body intact to its place of destination in the above-mentioned vehicle, it was decided to remove the flesh from the bones, which was done by boiling. The flesh was reburied in its former receptacle, and the bones taken to the graveyard of St. David's Church, Radnor, Newtown Township, Pa. In another part of the church-yard is the grave of Mary, the wife of the General, who died three years before her husband. Near this place Wayne spent his boyhood's days. The quaint appearance of this old ivy-clad church, built before 1716, is an object of admiration to all who visit it.

Sixteen of the brave fellows who fell in the massacre at Paoli, on the night of September 20, 1777, when Colonel Anthony Wayne and his men were surprised and attacked, are said to be buried in the little hollow west of the gallery stairs.

Rev. George Currie, a learned Scotch divine, held the incumbency for almost half a century, beginning to preach in 1736, and resigning, owing to political motives, in May, 1776. This he did through respect to King George, the head of the Church of England at the time. He again resumed charge in 1783, and energetically labored to repair the damages caused by the Revolutionary War. During that stormy period, religious services were seldom held in old St. David's. All the available lead that could be found about the building, even to that which fastened in the panes of glass in the windows, was utilized.

General Wayne's chaplain was a Baptist preacher, Rev. David Jones. He was a staunch, out-and-out patriot, serving faithfully from 1777 to 1783. As a general rule the Baptists were all patriots.

A historian of the church says of the pastor: "Old Davy Jones climbed into the lofty pulpit, and having glanced around, in order to assure himself of the attention of his audience, was completely disconcerted. He saw seated comfortably before him several young and active men, who had been hidden from view by the old-fashioned, high-back pews. In an instant patriotism had so completely mastered him that he threw away his sermon, and, shaking his fingers vehemently at the astonished youths, demanded to know why they did not go into the American army and fight the British. 'I'm not afraid to go,' he screamed; 'they can't hurt me. They may kill me, if they like, and make a drum-head of my old hide, but they will play a hummy-drum, drum, hummy-drum, drum, till the British are scared out of the country.' Then, in wild excitement, he threw off a heavy cloak which hung around his shoulders and displayed an American uniform."

At the time of his death General Wayne was Commander-in-Chief of the United States Army, and but fifty-two years old.

In 1809 the Pennsylvania Society of the Cincinnati erected a marble monument over the remains in the churchyard, eight feet high, at an expense of five hundred dollars. It was dedicated with imposing civic and military ceremonies. It bears the following inscriptions on the north side:—

IN HONOR OF THE DISTINGUISHED
MILITARY SERVICES OF
MAJOR-GENERAL ANTHONY WAYNE,
AND AS AN AFFECTIONATE TRIBUTE
OF RESPECT TO HIS MEMORY,
THIS STONE WAS ERECTED BY HIS
COMPANIONS IN ARMS,
THE PENNSYLVANIA SOCIETY OF THE CINCINNATI,
JULY 4, A. D., 1809,
THIRTY-FOURTH ANNIVERSARY OF
THE INDEPENDENCE OF
THE UNITED STATES OF AMERICA;
AN EVENT WHICH CONSTITUTES
THE MOST
APPROPRIATE EULOGIUM OF AN AMERICAN
SOLDIER AND PATRIOT.

On the north side:—

MAJOR-GENERAL
ANTHONY WAYNE,
WAS BORN AT WAYNESBOROUGH,
IN CHESTER COUNTY,
STATE OF PENNSYLVANIA,
A. D., 1745.
AFTER A LIFE OF HONOR AND USEFULNESS,
HE DIED, IN DECEMBER, 1796,
AT A MILITARY POST,
ON THE SHORES OF LAKE ERIE,
COMMANDER-IN-CHIEF OF THE ARMY OF
THE UNITED STATES,
HIS MILITARY ACHIEVEMENTS
ARE CONSECRATED
IN THE HISTORY OF HIS COUNTRY,
AND IN
THE HEARTS OF HIS COUNTRYMEN.
HIS REMAINS
ARE HERE DEPOSITED.

The old block-house was destroyed by fire about thirty years ago, the parade ground graded off for a fair ground, and every trace of the old hero's grave was lost.

In 1872, during the small-pox epidemic, the city of Erie erected a pest-house or hospital on Garrison Hill. While digging the cellar of the building, some Indian relics and old military buttons were found and preserved by the physician in charge of the hospital. In 1876, this physician, in going to and from his duties, rode a lively horse, and, as he galloped over the green sod of the hill, his attention was attracted repeatedly, at a certain place, by a hollow, rumbling sound. Directing one of his assistants to examine the spot, they discovered the lost grave of Wayne, on January 7, 1876. On opening the coffin, it was found to contain pieces of dark material, like dried flesh, and four old English knives, with hooked ends. The lid of the coffin was marked, as before described. Near the grave was also found the foot-piece of the old flag-staff, made of two large chestnut logs in the form of a cross. The news of the discovery spread with great rapidity, and caused throughout the State a feeling of deep satisfaction. On the coming Decoration Day a squad of veterans visited the grave. In 1879 the State appropriated one thousand dollars, and soon after five hundred dollars more, for the purpose of erecting a monument on the spot. The committee who had charge of the execution of the monument were Capt. J. H. Welch, Mayor D. T. Jones, and Dr. E. W. Germer.



Block-House at Fort Presque Isle.

They placed a new stone over the grave, and built over it, as a monument to "Mad Anthony's" memory, an exact copy of the old block-house, which Wayne himself had first built in 1791. The present one is made of squared oak logs, well notched together at the corners. The first story is sixteen feet square and ten feet high, with a door in one side. The upper is octagonal in shape, and made to project several feet over the lower, thus making it difficult of access, except through the interior of the lower room. A flight of winding steps permits of ascent to the upper octagonal room from the ground floor of the block-house. The roof is also octagonal, and finished to a centre pole, which forms the flagstaff. The upper story is the height of a man at the sides, and increases with the rise of the roof to the centre.

From this room the view over the harbor and lake is very fine. On each of the eight sides of the house there are port and loop holes for guns and rifles. The grave is at one side of the lower room, and the new slab which covers it is inscribed thus:—

ANTHONY WAYNE,
COMMANDER-IN-CHIEF OF U. S. ARMY,
DEC. 15, 1796,
AGED 52 YEARS.

What is left of the old coffin-lid is preserved in a frame, and covered with glass. The old inscription, made with flat-headed brass nails, can be legibly traced. The block-house contains nothing but this lid and the slab marking the grave. On the outside are four parrot guns, sent by the Secretary of War, at the request of President Grant. All are in the care of a custodian, who entertainingly

[1] Continued from page 114, number 584.

regales visitors with the abundant stories of olden times, when Mad Anthony whipped the Indians.

This monument is *unique*, and as interesting as the most exacting critic or admirer of Wayne could wish. It is more than a mere illustrative reproduction of a primitive fact; it is a forcible and artistic symbol, and, for its time and purpose, more vital than any higher symbol could possibly be. It brings back the stormy, trying days in which Wayne lived and fought, and when this old structure was a place of refuge, and a pillar of defense by night and day, for the early settler, against the merciless savage.

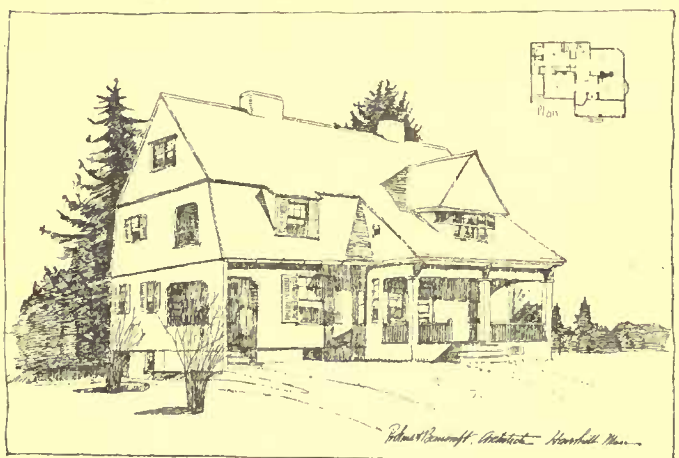
The Stockbridge Indian memorial and the Canonicus boulder belong to the same species of idea, though their suggestiveness is limited, while this is unlimited and comprehensive. It shows an appreciation for the dead, as rare as it is admirable. Contrast it with the prevalent ideas, or rather lack of ideas, seen in memorials in this country. It is not a museum, a town-hall, or a hundred-ton monstrosity from a granite yard.

The modest way in which the committee speak of their work is also to be noted. "We wished to preserve the grave and memory of General Wayne, as the hero of Stony Point, and the beau ideal of the Revolutionary soldier."

If the projectors of the monument to Red Jacket would take the same point of departure as that acted upon by those who put up the Wayne memorial, they could add one more to the few worthy monuments of the country. T. H. BARTLETT.

[To be continued.]

DOMESTIC ARCHITECTURE IN JAPAN.



·House at Bradford Mass for Mr·Chas L: Bly·

MR. JOSIAH CONDER, R.I.B.A. (*Soane Medallist*, 1876), left England ten years ago to become Professor of Architecture at the Technical College of Tokio, and also architect to the Japanese Government. He sent home, in 1878 and 1886, Papers on the Architecture of Japan, which are published in the *Transactions*, and his works at Tokio comprise residences for the Imperial Princes Arisugawa and Kitashirakawa, offices for the Imperial Household Department, the National Art Museum, portions of the new University Building, official residences, and other buildings. Mr. Conder, who is in England for a short time, read a paper before the Royal Institute of British Architects, February 28 last, and illustrated it with original drawings, and a model of a Japanese house.

In describing the domestic architecture of Japan, the author should, he said, have occasionally to allude to certain habits of life pertaining to the people of that country; some of them the rational results of climate, many of them closely associated with romantic tradition, but not a few belonging more to the passing than to the modern type of civilization. In Japanese houses separate rooms are not set apart for distinct and particular household purposes, as is the case in European dwellings. The bed-room, as a distinct apartment, can hardly be said to exist in the ordinary dwellings. As a general rule, any room is converted into a bed-chamber by spreading sleeping-quilts and pillows upon the matted floor. During the day-time such bedding is secreted in spacious closets arranged between the walls of the different rooms. The Japanese make constant use of the hot bath, and all the best houses are provided with a bath-room. The usual time for taking the bath is the afternoon or evening, so that the morning ablutions are simple, and are conducted, not in the sleeping-apartment, but in the lavatory, or, in some cases, even at the well-side in the garden, or kitchen court. Privies are provided at the end of the veranda passages, and just opposite to them in the garden is invariably an ornamental water-basin provided with a ladle. The mats, called *tatami*, used to cover the floors of all living-rooms, are of the fixed size of six feet by three feet, and rooms are described by the number of mats that they contain. Passages, verandas, part of the kitchen and the closets are boarded, such boarding quickly assuming a natural polish from the daily rubbing with wet cloths which it receives. Food is served to the different rooms upon small trays, one to each individual. In winter large metal-lined boxes, or bronze vases of live charcoal are placed in a room when in use, and in summer smaller fire-boxes are provided for lighting the pipe at. The candlesticks, or lamps used at night, one or two chests of drawers, small low tables for writing upon, boxes containing paper and ink, little shelves for the cups, and occasionally, in the most luxurious dwellings, a small lacquered cabinet, and a screen or two complete the furniture of an ordinary house. In every house, one room or more will be provided with an alcove or recess, called *tokonoma*, and a corresponding recess, occupied either by ornamental shelves, or by a closed store-closet.

The general mode of living in a Japanese house being understood, it would be easier, the author said, to appreciate the different arrangements which the builders have produced for administering economically to such wants. He showed a drawing of a small middle-class house, and another of a somewhat larger one-story building, formerly occupied by a private gentleman of the upper class. The former contains a vestibule, a small three-mat ante-room, one large seven-mat room, another room of six mats with a *tokonoma*, a kitchen, closets, privy, and back entrance. Such a dwelling would be surrounded on two sides by a little garden, containing a few shrubs, evergreens, stones of irregular shape, perhaps a stone garden-lantern and a hill or two. A small miniature pond might also be introduced. The whole would be surrounded by a garden fence, entered through a picturesquely-roofed wicket-gate. The internal constructional woodwork and the boarded ceilings of such a house would be carefully selected, and some pale neutral tint would be given to the plastering. The *ramma*, or frieze space, would be filled in with thin planks of clean wood, having some quaint pattern cut through, free or conventional. The other drawing shown was a good example of the best class of house, secondary only to the large summer pavilions of the nobles and their old feudal mansions. The approach is under a porchway paved with cement, having a high wooden step leading to the enclosed matted hall, four mats in area. At the side of this hall is a three-mat room for domestics, with large and small closet. The hall opens into a small inner hall or lobby of two mats, communicating with one of the principal sitting-rooms of eight mats in area; and at the back with an inner gallery which surrounds a central court or garden. On the right of this garden is a wing containing kitchen, servants' hall, and bath-room; and this wing, towards the front, adjoins the room devoted to hall-servants, though somewhat set back from the main frontage of the house. Beyond the eight-mat room mentioned is the principal room of the house, fifteen mats in area, and decorated at the farther end with an ornamental recess (*tokonoma*), and decorative shelves (*tana*). Behind this room, and forming a group on the farther or west side of the inner garden, are four smaller rooms, one eight mats, and the others six mats in area; of this group one has a *tokonoma* and *todana*, or closet, and the others closets only. At the back of the whole residence is an oblong block containing a large store and two small rooms for female servants, with separate entrance. As is almost invariably the case in the best houses, the principal rooms form an internal angle towards the garden, which is generally on the south side of the building. The whole of this side has a boarded veranda with a latrine at the end. Other conveniences are provided, one near the bath-room, and one at the back of the farther block. A house such as this would be provided with an extensive garden on the south and west sides, and a small garden of different character in the internal court or area. The style of garden employed within would be what is called the Hakeniwa, a flat garden of beaten earth, kept slightly damp and cleanly swept, dotted with quaint paths of stepping-stones, and rather thickly planted with low trees and shrubs. The outer garden would be of more free and open character belonging to what is called the *Sansui* type, a word implying mountain and water scenery; and designed to suggest some natural landscape.

The refined Japanese gentleman of the old school generally boasts some acquaintance with the philosophy and ceremonial of tea-drinking, and will adorn his grounds with one of those curious little buildings, called *Chashitsu*, intended for the preparation and enjoyment of this refreshing beverage, amid the hospitable formalities with which the pastime is surrounded. The construction of these buildings is in keeping with the tinyness of the arrangements, and the most exquisite care and neatness is displayed. The author showed a plan of one of these buildings designed by the greatest professor of the *Cha-no-yu*, Sen-no-Rikiu, and described its arrangements and construction in detail.

Numerous types of houses used by the upper classes might be given, but the one previously described was sufficiently characteristic. The time at the author's disposal did not admit of his describing these at length, nor of reading all that he had written on the subject of the *Yashiki*, or town residences of the territorial nobility; and of the castle-palaces. The latter consist of an extensive group of one-storied buildings compactly arranged, and divided at intervals by inner courts or small gardens. The principal palace of the latest *Shogun*, or Military Regent, in the Castle of Yedo, which was years ago burnt to the ground, covered an area of more than two acres. The military character of such buildings necessitated greater compactness in planning than was adopted in the imperial palaces; and whereas the latter, as may be seen in Kyôtô, consist of a number of almost detached blocks connected by long covered ways, the former were more under one roof, the succession of rooms was less broken, and the inner courts and gardens were introduced only where absolutely necessary for purposes of light and ventilation. In the matter of internal decoration, however, the castle palaces are far more gorgeously embellished than those of the imperial buildings. The *ramma* are elaborately colored and gilt, the ceilings have painted silk

panels and lacquered frames, and the only undecorated portions are the posts and lintels, which are invariably of plain white wood. . . .

The whole of the imperial buildings are, without exception, of one story only, and present very few striking architectural features on the outside. The roofs are of picturesque curve, though decidedly heavy looking, and are covered with thick layers of pine shingles. Terminals and ridges are executed in wood, covered with copper-plate, and with a little gilding in parts. The gables have barge-boards and carved pendants. The eaves, with the exception of those of the Shishinden, have not the rich bracketed cornices generally found under them in temple buildings, but are much simpler.

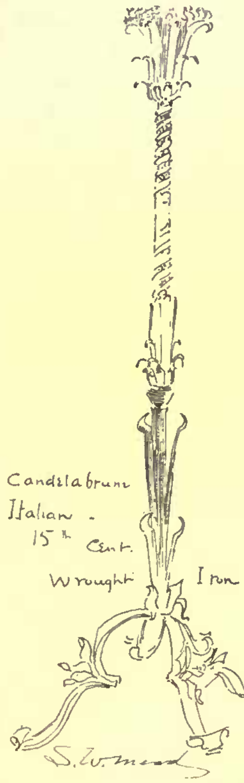
The principal features of interest upon the exterior, are the elegant balustrades and hand-rails of the external galleries and staircases, and the wooden screen divisions which separate the verandas into parts. The vista of interior rooms, always seen from the outside, attaches interest to an otherwise bare and monotonous elevation. . . .

No Japanese roof is of one continuous slope. It has a steep pitch towards the top, becoming flatter towards the eaves. The two slopes combine in a slight parabolic curve. These roofs are themselves of extreme weight, and, when covered with snow, the weight, as Mr. Hansard surmised, is very great; but you must bear in mind that in Japan the idea of carrying the whole weight of your roof on the external walls by means of ties, stays, and so forth, is not followed. The roof is supported from as many points in the interior of the building as possible. The roof, in fact, consists of a number of partition-walls, whose heads have been cut off to the slope required, so that the weight is considerably spread over the area. With regard to the *Amado*, or rain-shutters, the Japanese house, in a storm, is rather a noisy place to be inside of. The shutters rattle, and it is necessary that they should all be tightly fastened up to prevent the risk of one or two of them being blown out. But the whole building cannot boast of any great solidity, so that the shutters are, perhaps, as well off as any other part. With regard to the glass, I may state that since glass was introduced it has become usual to use it a good deal in place of paper. If the slides, which run round three sides of the house, were filled up with glass, what a bleak and bare feeling the rooms would have! This feeling is somewhat relieved by having a partially opaque paper between you and the outside, so that the effect of introducing glass into Japanese buildings, although practically it may exclude the air and wet a little better, is rather a drawback than otherwise. A kind of compromise is often used by making the central pane only of glass and leaving the remaining ones of paper. The Japanese originally took their architecture, as well as all their arts, from China, and many modifications have taken place in this style as introduced from China, but changes have also taken place in China. The result is that the present Chinese style is very different from the Japanese, but it is difficult to know exactly how much the present Japanese style is like the old style in China, which Japan first took from that country. It is probable that in those old times the Chinese style was also a wooden one. As you know, China now uses, to a great extent, more solid materials. The pagodas which in Japan are invariably of wood are in China built of brick, and very often coated with porcelain. . . .

I maintain that there is nothing in the construction of Japanese buildings in any way to make them suited to earthquakes. They are, seismologically, exactly the opposite of what earthquake structures should be; they are extremely top-heavy to begin with; they have no diagonal ties nor any braces whatever. In the earthquake shocks, with which, in Japan, we are familiar, these buildings sway about palpably in the most alarming manner, and no builders or architects of the old style that I have met with have ever, in any way, laid claim to earthquake advantages in their designs. That is a curious matter in respect of the pagoda posts which I know was fully discussed before. My opinion is that the central post was put up in the pagoda to stiffen it against wind, and to contribute to its general stability. It certainly does not act as a pendulum. The pagoda is a structure which you may liken almost to a cardboard house. You know the manner in which a house is built of cards by placing two cards vertically, and then others over them in a slanting position, and repeating the operation to several stages. That is somewhat the way in which the Japanese pagoda is constructed. The central post is necessary as a stiffener to the whole. There are, however, cases in which these central posts do not quite touch the ground. The reason for this I have scientifically explained in former papers and in letters, so that I will not take up your time by resuscitating this subject.

A NATURAL ELECTRIC ROCK.— A very peculiar property has recently been discovered in the rock of a mountain seven miles from Santa Cruz. This rock is heavily charged with electricity, and when applied to a battery was found to produce strong electric currents. A small handful of this rock applied in a battery generated sufficient electric force to operate the battery for three weeks, and appeared not to be the least exhausted of its powers. This rock has very much the appearance of ordinary soapstone, and exists in immense quantities, constituting the principal mass of the mountain. Its strange property was accidently discovered by a man who was experimenting with mineral-water on the mountain, and who, having occasion to use some of this rock, placed it in contact with the battery. The man who made this wonderful discovery kept it a profound secret from the world until he and one or two of his confidential friends had obtained a title to the portion of the land, paying $15,000 therefor. The present owners are now experimenting with this rock with a view to thoroughly testing its properties. — *Iron.*

THE LATEST STEP IN CIVILIZING JAPAN.



EVER since the bright little empire of Japan started upon the course of modern progress its rulers have lost no opportunity of springing surprises upon the outside world, writes a correspondent at Tokio to the *New York Tribune*. Most of these have proved to be naturally and properly connected with a definite system of development, however contrary to the national traditions they may have originally appeared. The adoption of the Gregorian calendar, for example, could have been undertaken only by a government thoroughly confident in its own strength and well assured of the docility of its subjects. It was as unwelcome to the mass of the people as any possible change could be, but it afforded a striking evidence of determination to bring the country into more direct accord with European and American ideas. The order requiring all government officials to wear foreign clothes seemed at first arbitrary and trivial; but its enforcement relieved the Japanese diplomatists from much of the impertinent curiosity to which they had been subjected, and greatly simplified the conditions of their intercourse with strangers. Each year has witnessed innovations, political as well as social; the announcement of which has excited general astonishment, not to say anxiety. In almost every instance, however, the measures have resulted satisfactorily, and the apparently rash experiments have turned out to be short cuts in the direction of practical and substantial reform.

There are occasions, nevertheless, when it seems impossible to reconcile the government's proceedings with any rule of discretion or sound judgment. Ancient usages are assailed and overthrown, not under stress of necessity, not from consideration for the popular welfare, but, so far as can be discovered, from some motive scarcely compatible with the country's true interests. A movement of peculiarly radical sweep, to which no person can attribute a sufficient cause, is at this moment agitating the entire body of Japanese society, throwing one sex into excitement and bewilderment, and spreading dismay through the ranks of the other. The Empress has emerged from her conventional seclusion, and, in a document which certainly has no precedent in Oriental history, has signified her will that the women of the empire shall put aside their customary dress — the dress of their ancestors from time immemorial — and adopt that of the remote West. That a Japanese Empress should address her subjects on any topic is marvellous enough. That the national costume should be her topic is more marvellous, and that she should recommend this remarkable substitution is most marvellous of all. In fact, however, her majesty is in no direct sense responsible for the transaction. It is purely an affair of State, which has occupied the attention of that supreme circle of councillors, known as the Dai Jo Kuwan, for at least five years. Ever since 1882 this austere assemblage has been industriously and ardently studying the question of dress-reform. The libraries of the Senate House have been loaded with fashion prints and periodicals from Paris, and the ante-chambers filled with mysterious structures of wire and whalebone, the aspect of which might have awakened unfair suspicions that a return to the barbarities of punishment by torture was contemplated. Whatever may be the underlying purpose of the impending change, it will not have been instituted without ample deliberation. The extent to which the investigations have been carried, and the methods employed, would form an amusing chapter of Eastern court records, if the details could be unreservedly revealed.

Whether the august gentlemen who govern Japan held it beneath their dignity to appear as the originators of the project, or whether they doubted their own authority in so delicate a matter, must be left to conjecture. Having decided what was to be done, they took the discrete, if not altogether valorous, course of communicating their intention through the mouth of the Empress, whose person is dear to all in Japan, and whose words would be sure, in almost any case, to command respectful obedience. Her proclamation was issued at the beginning of this year, and before the holiday festivities were over the ladies of the capital were rivalling each other in the most extravagant efforts to conform to its admonitions. The results of their struggles are not yet apparent, but it goes without saying that they will make a dreadful mess of everything, and when the newly-ordained fashion extends all over the land, the consequences will be distressing. Nothing could be more dainty, graceful, and becoming than the familiar garb of the women of Japan. If not in all particulars a model of convenience and comfort, it is in those respects far superior to the style by which it is to be replaced. The freedom and ease which its wearers have enjoyed must now be exchanged for a constraint to which they cannot become accustomed for generations. They will not only suffer in the flesh themselves, but will be cause

of suffering in the spirit to others, for they will be hideous to behold. The idea of accommodating their frames to the incoming modes cannot be grasped by them. With many advantages of form, especially in the upper part of the body, they have certain defects which will be cruelly aggravated by the uncongenial attire. Not one in a thousand will know how to walk, for the peculiar gait which has been established and confirmed by centuries of habit will cling to them as long as they live. Undoubtedly there may be exceptions; but every one conversant with the subject knows how rare they must be, and can testify that the very prettiest of Japanese girls is apt to be transformed into an apish counterfeit of gentle humanity when she arrays herself in anything but the pliant and picturesque native robes. That the novel apparel will be accepted willingly, and even with enthusiasm, is very possible, for the mere name of fashion has a spell of fascination which no woman in any corner of the earth can easily resist; but it must be accepted at the cost of the power to charm for many a year to come.

As for the men of Japan, there is nothing that can make the change tolerable to them. In the first place, the expense will be a crushing weight. Half a dozen feminine costumes, though of the most commonplace description, would exhaust the revenue of an ordinary Japanese for a year. It may be set down as a certainty that the great majority will find it impracticable to comply literally with the requirements of the edict. The real foreign vestments being unattainable some sort of substitute must be devised, the effect of which will probably be still more harrowing. In the large towns a moderate number of wealthy heads of families may supply their household goddesses with the proper material, and, perhaps, a suggestion of the proper style. But it will be a sorrow and a shame to them to see their wives and daughters thus arrayed, especially on occasions of ceremony. The European "dress of rigor" is an abomination to the eye of all Japanese men. In their estimation a woman might as well appear stark naked before the public as expose herself in its scanty folds. This, also, was the conviction of the women up to the close of 1886. Since then the Empress has spoken. The Empress decrees fashion, and fashion mocks at antique prejudices. They will harden their sensibilities, and the objections founded on scruples of delicacy will not long survive.

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE PARK AT UYENO, JAPAN.

[Gelatine Print, issued only with the Imperial Edition.]

"NO traveller should fail to visit Uyeno. Originally the Tō-dō family, the property thus named was taken over by the Shō-gun Iye-mitsu, in the year 1625, for the purpose of erecting here in the northeastern (and, therefore, according to a prevalent superstition, the most unlucky) portion of the new capital a series of Buddhist temples that should surpass all others in splendor. The original main temple then raised stood in front of the site of the present museum buildings, and was burnt down in 1868 when a bloody battle was fought between the Imperialists and the supporters of the Shō-gun's government. It was indeed one of the chief triumphs of Japanese architectural skill, and was considered the metropolitan of all Japan. The high priest, always a son of the reigning Mikado, was kept here for political reasons, as it was convenient for the Tokugawa rulers to have in their power one who could at once be decorated with the Imperial title if at any time the court of Kiōto should prove unfavorable to the policy of the Shō-gunate. The last high priest of Uyena was thus raised to the throne by the Shō-gun's partisans, and carried off by them to Aidzu; but on their defeat was pardoned by the present legitimate sovereign, and sent to Germany to study. He is now known by the title of Prince Kita Shirakawa. The park, in which stand such of the temples as still remain, has been made public, and is, together with Mukō-Jima, the chief show-place for the cherry-blossoms, all Yedo assembling here to admire them on fine afternoons in the beginning of April. . . . Returning to the main road, the visitor has on his left the shallow lake known as Shinobazu-no-Ike, celebrated for the beauty of its lotus flowers in August. On the peninsula which juts out into it are a number of tea-houses and a small temple in Riō-bu Shin-to style dedicated to the goddess Ben-ten, and founded by Ji-gen Dai-shi." — *Murray's Hand-Book of Japan.*

JAPANESE ARCHITECTURAL DRAWINGS.

WE reproduce, as a matter of interest, when taken in connection with Mr. Conder's paper, published elsewhere in this issue, detached specimens of a series of original working-drawings prepared as samples of Japanese architectural drawing, under the direction of the Japanese Department of Education, and by it shown at one of the recent exhibitions in London. We are given to understand that, complicated as these drawings appear, there is probably no ordinary village carpenter in Japan who could not understand them and follow their instructions. The way in which these drawings are folded up into the form of the common Japanese pamphlet show that our own tracings of working-drawings might be mounted and folded in the same way, and thus become more easy to handle and be more accessible as to their contents than the ordinary roll of tracings, which with such persistent vexatiousness never will stay open.

DESIGN FOR AN EPISCOPAL CHURCH. H. HOPPIN, ARCHITECT, PROVIDENCE, R. I.

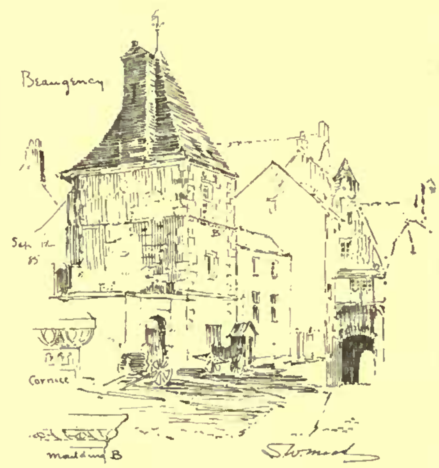
THE accompanying sketch is one of the designs made for a small Episcopal church near Providence. Outside to be covered entirely with rough shingles, oiled. Trimmings painted a dark bluish-gray, and roof stained to a darker shade of same color.

EPISCOPAL CHURCH, KENNEBUNKPORT, ME. MR. HENRY PASTON CLARK, ARCHITECT, BOSTON, MASS.

GATEWAY AND TEMPLE, YOMEI, NICCO, JAPAN.

DESIGN FOR A CITY HOUSE. MR. H. GILLETTE CLARK, ARCHITECT, NEW YORK, N. Y.

UNITED STATES GOVERNMENT BUILDING PRACTICE.[1] — III.



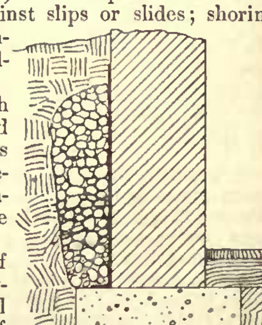
DRAWINGS. — It is necessary to state that the drawings generally for all classes of work should show so clearly every portion of the work to be put under contract, that there can be no mistake about any dimension, or as to what kind of materials are intended; and the specifications are drawn taking for granted that such is the case with the drawings.

EXCAVATING.

Clearing the Site. — The Government will remove any building, rubbish, etc., that may be on the site, and will lay out the plan of the building on the ground, and give the contractor the lines, levels and stakes necessary.

The drawing for excavating locates the building upon the lot and shows the extent of the general and trench excavation, and the various depths to which they are to be carried.

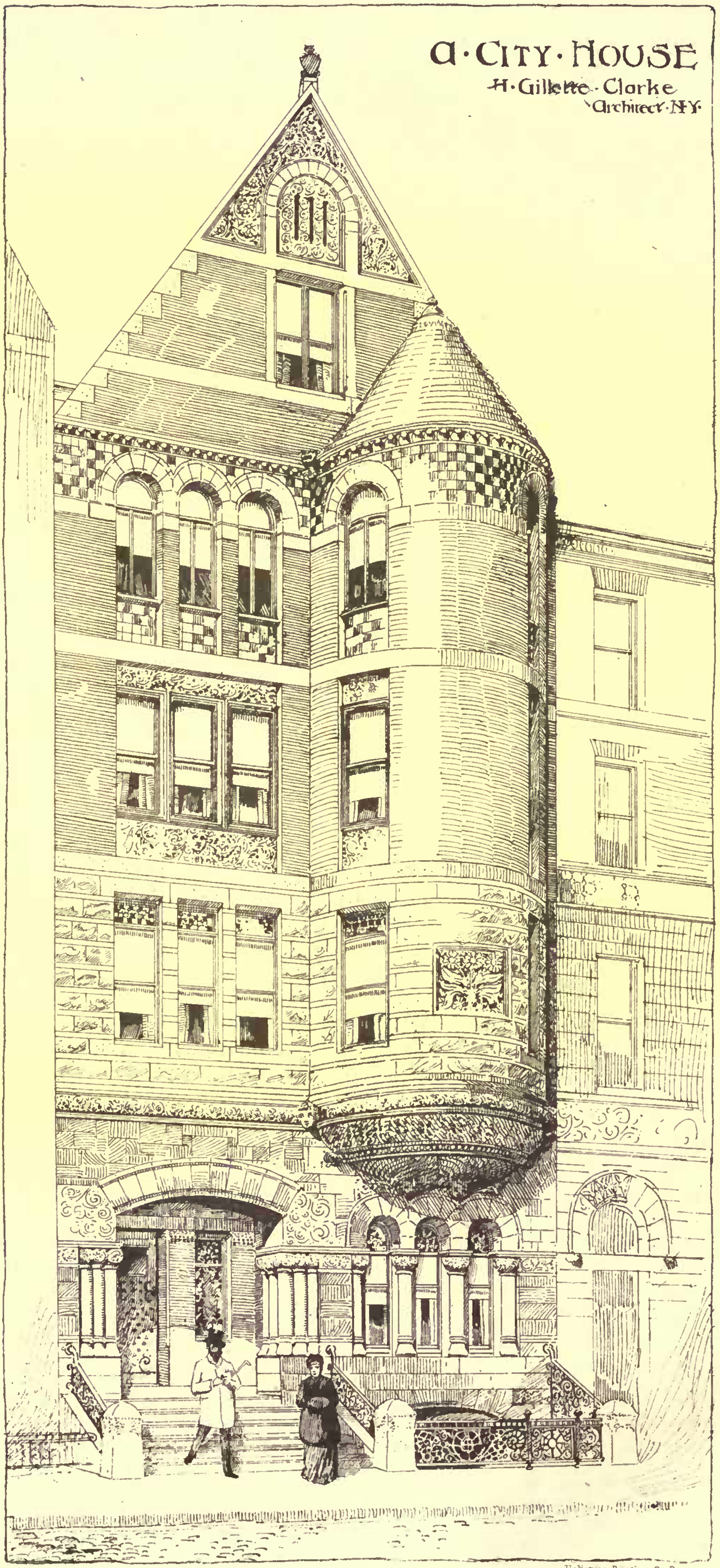
Excavating. — The general excavation for basement areas, steps, etc., to be made of the dimensions noted on the drawing; the sides to be cut to the incline shown and the bottom made level; the trenches for foundations, footings, etc., to be the widths and depths noted, the sides cut plumb and the bottoms perfectly level; all earth to be removed from the premises, except such as may be wanted for filling-in, which must be deposited at some place to be designated by the superintendent. The bottoms of all trenches must be truly levelled, properly stepped where necessary and as shown; and if at any point after the depth of trench indicated by drawing is reached, solid ground is not found, the excavation must be continued until, in the judgment of the superintendent, a sufficiently stable foundation is obtained. The contractor must also prepare and keep open all trenches necessary to keep surface-water from running into trenches of foundations or into cellars. Should the pit be flooded with water, it must be removed (drained, if possible) at the expense of the contractor; all precautions to be taken against slips or slides; shoring to be provided and put up by the contractor wherever necessary, and all boulders, if any, to be removed.



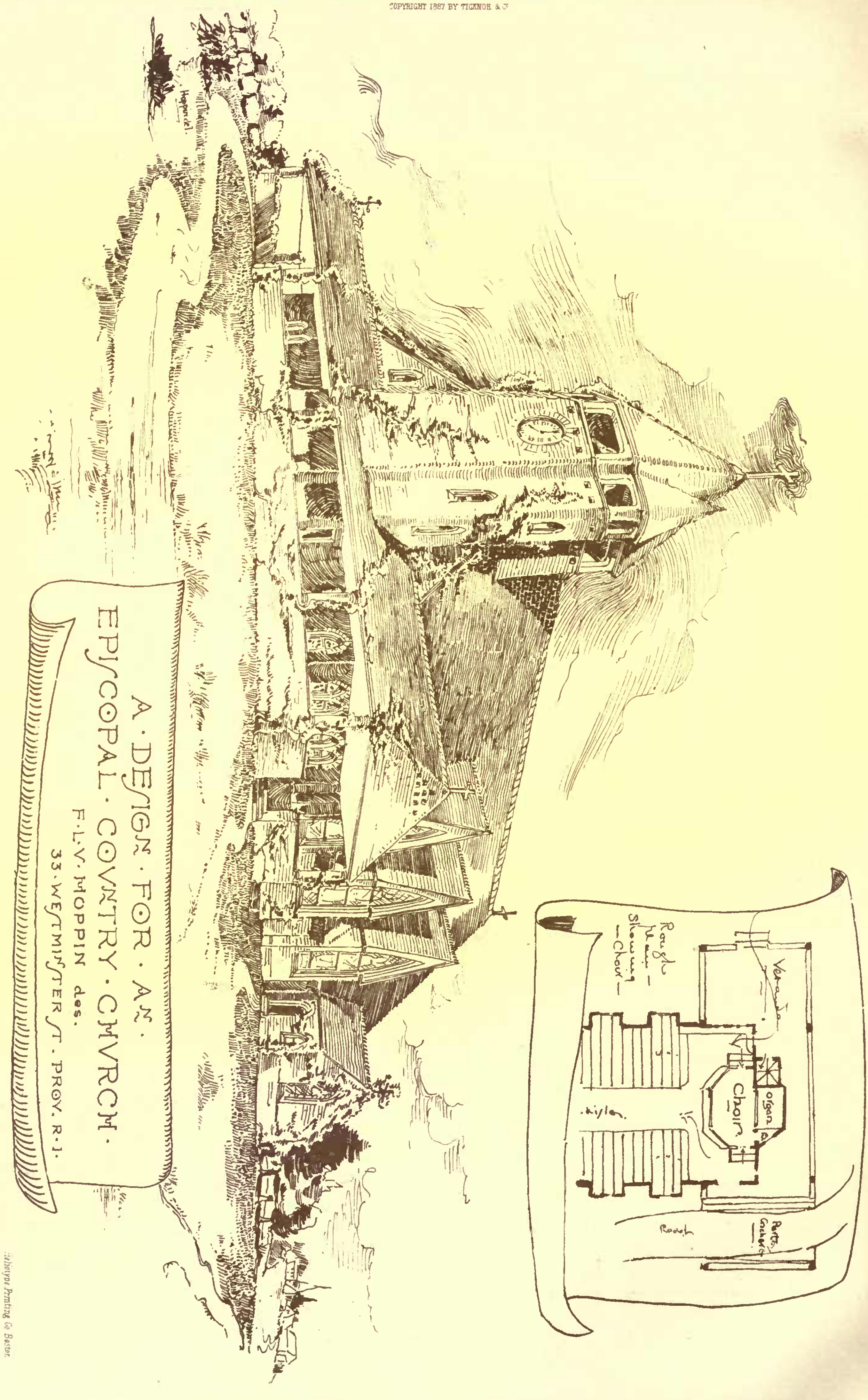
Filling-in.—After walls are built, earth to be filled-in against them and packed solid to the required lines; all surplus earth not required for grading to be removed from the premises, and, at completion of contract, the grounds to be cleared of all rubbish, etc.

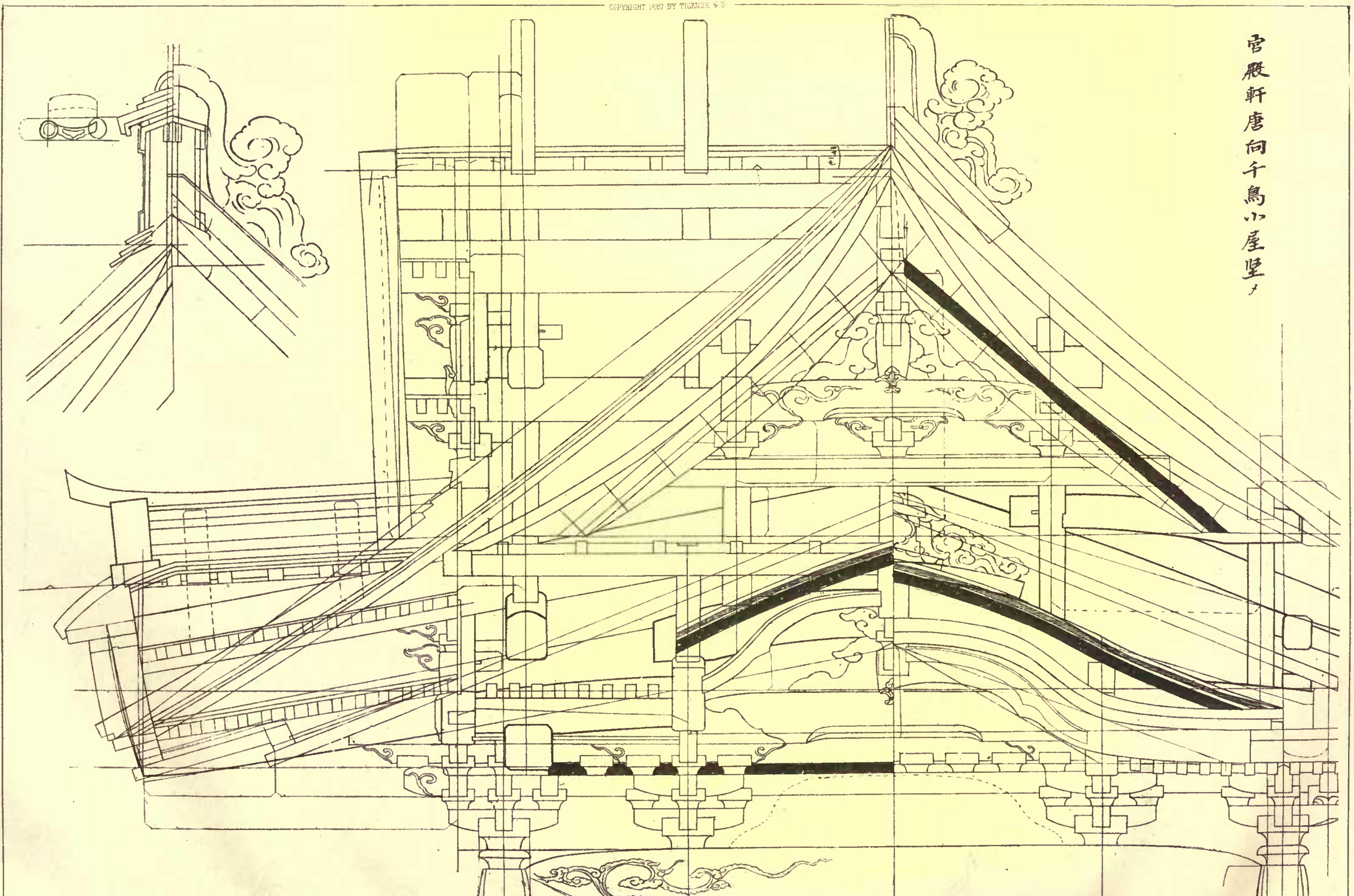
In damp soils against the outside of walls, below grade (if of brick, to be covered with asphaltum or coal-tar), small broken stones to be filled-in from top of concrete foundations to within one foot of grade line, the remaining space to grade line to be filled with earth rammed solid, and graded to take water away from building; outlets at the corners of building to be provided, for taking the water from these drains into sewers or elsewhere, away from the foundations.

[1] Continued from page 115, No. 584.

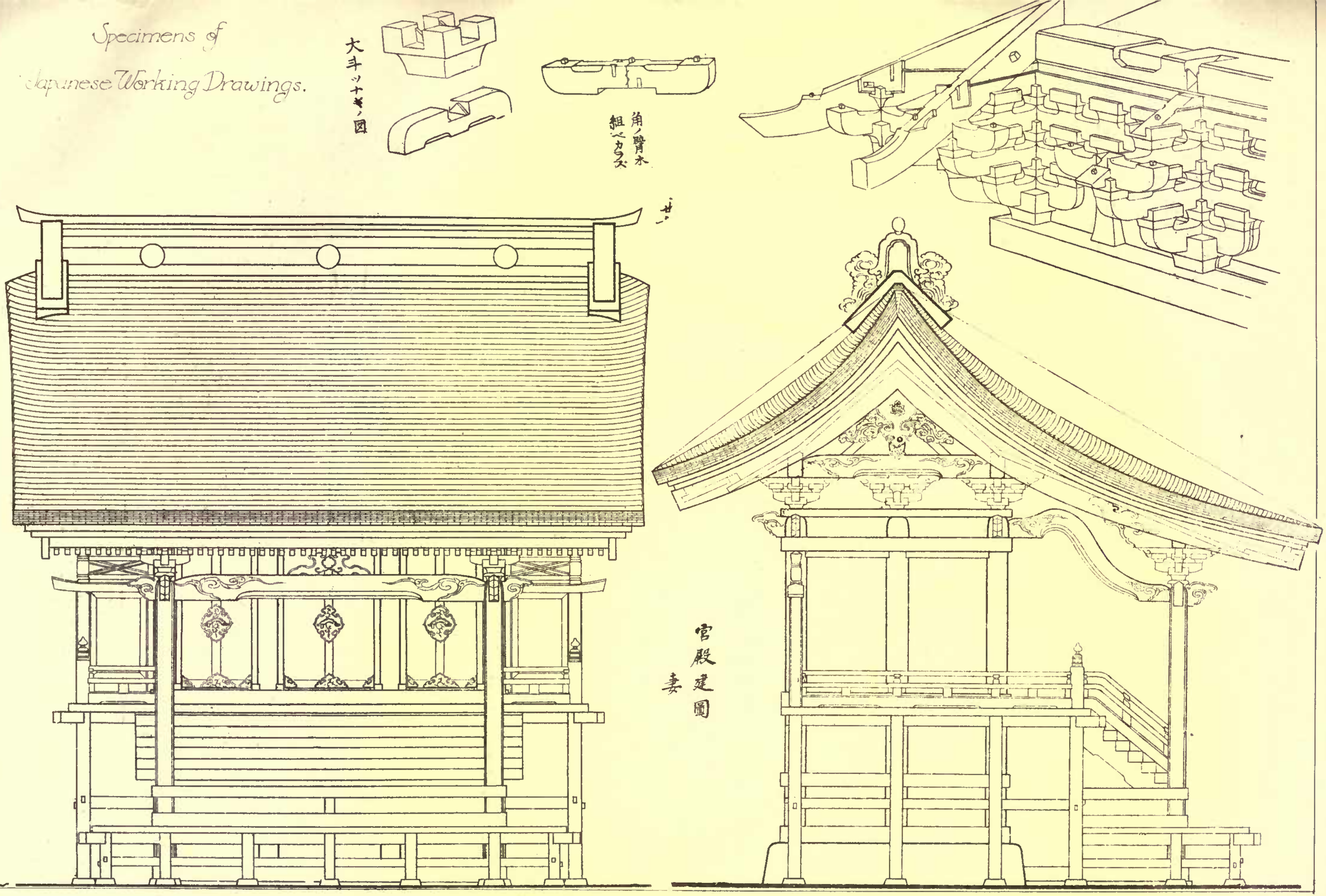


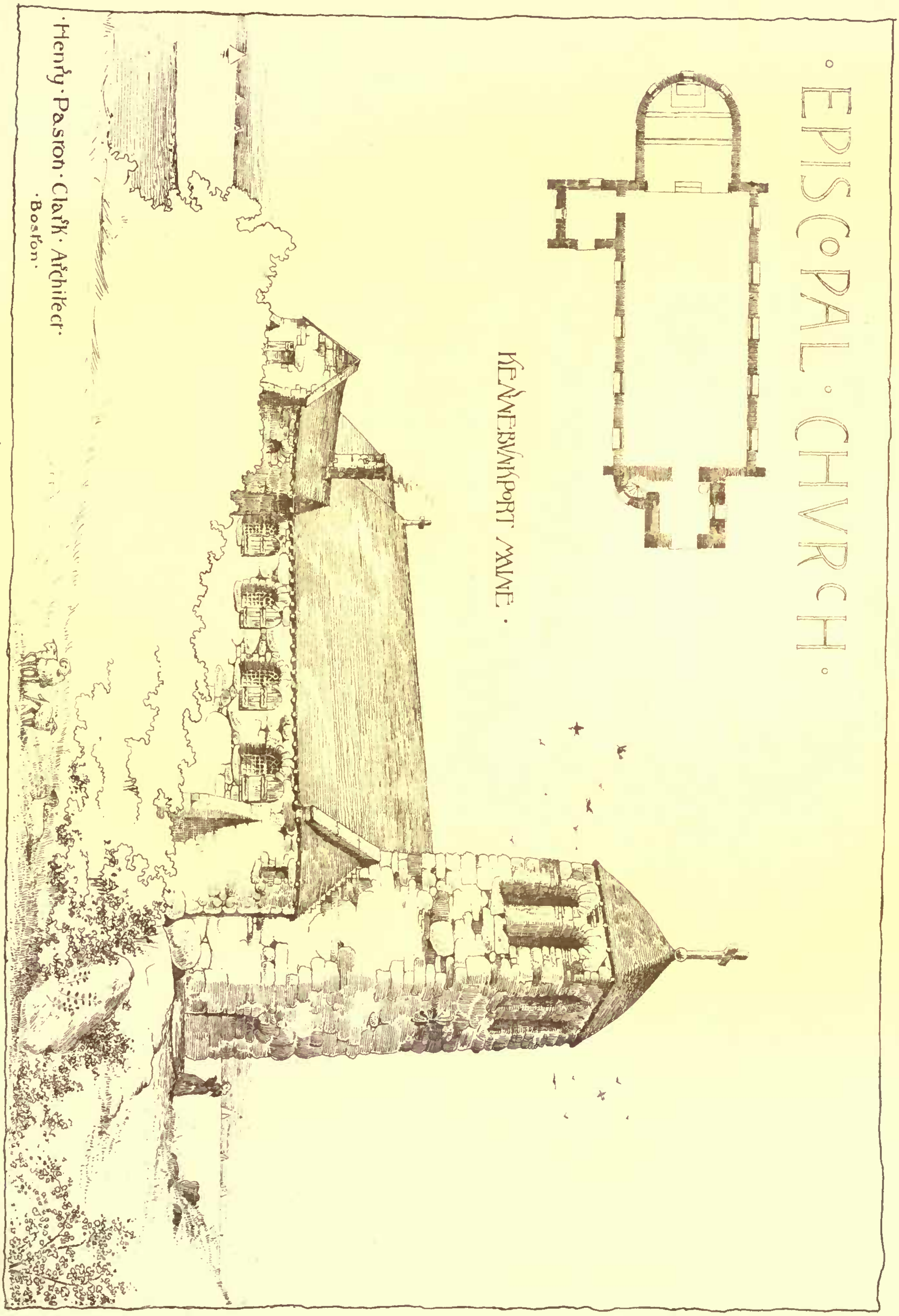
Heliotype Printing Co Boston


A · DESIGN · FOR · AN ·
EPISCOPAL · COUNTRY · CHURCH ·
F · L · V · HOPPIN des.
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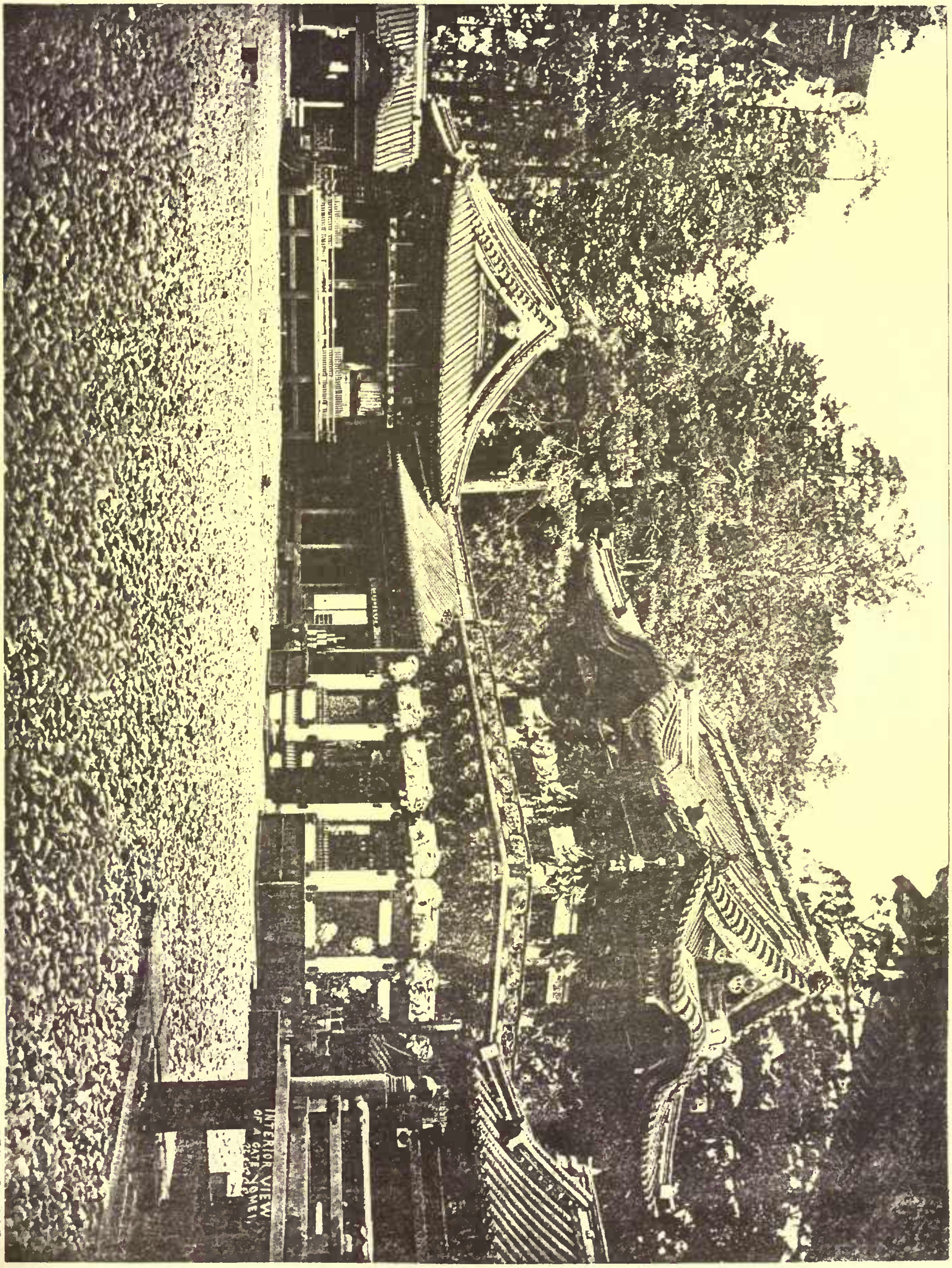

宮殿軒唐向千鳥小屋堅メ

Specimens of Japanese Working Drawings.





Heliotype Printing Co. Boston


INTERIOR VIEW
OF A GATE,

Grading and Terracing. — The lines of terracing and grades is shown on the drawing; all excavating and filling-in required to be executed, and any surplus earth or rubbish to be removed by the contractor; the grades to be so that water will run from the building, walks, etc., to the gutters or outlets. Arrow-heads show the direction in which the water is to run. Terracing should not be at a greater angle than 60°, and then it needs very careful sodding and attention until the sod has thoroughly taken root.

Soiling and Sodding — After the lot has been carefully graded and terraced to the required lines, the contractor to provide and fill in a soil four inches thick, of rich loam, and the sod, which must be of the best quality, freshly cut in sizes about twelve inches square (not over sixteen inches square), and must be neatly laid, breaking joint (the jointing to show as little as possible) and watered and maintained by the contractor until the sod has taken firm root and growth is assured. Where the grade of a terrace exceeds 40°, the sods should be laid horizontally in courses, each lower course projecting beyond the upper course, so there will be no risk of washing the sod out of place, before it gets firmly set.



MEASUREMENT.

Excavating is estimated by the cubic yards of earth in place before the ground is broken. The measurements are made from the drawing in feet, and the number of cubic feet divided by 27 gives the number of cubic yards; the length of the excavation or trench multiplied by the width, and this product by the height, giving the number of cubic feet.

Trench excavation, where accurate estimates are desired, should be estimated separately from the general excavation, because the ground for general excavation can frequently be broken by the plough, and a scoop used to get it out of the pit; whereas trench excavation can only be done with pick and shovel, and consequently costs a little more.

Filling-in with earth is estimated by the cubic yard, and costs about the same as general excavation, as the ramming is almost equal to the cost of breaking ground.

General excavation is considered to be all the earth to be removed from outside lines of foundations, and from the natural grade or surface of the ground to the bottom of foundation for basement floor; all below this plane is considered trench excavation.

Whenever any portion of an excavation is of different depth from another, it should be measured separately; the contractor should not depend on judgment for an average depth, where there is a wide margin for difference of opinion.

Where the natural surface of the ground is irregular, it is necessary to arrive at an average depth for the general excavation; this may be done in two ways: First, by dividing the entire area of the excavation into a number of equal rectangles, get the average depth of each rectangle, by adding together the depths of the four corners and dividing the sum by 4; adding the average depths of all the rectangles (truncated prisms) together, and dividing by the number of rectangles, will give the average depth of the entire excavation; multiplying the area by the average depth, gives the number of cubic feet in the excavation. The second, which is a more accurate, and frequently a shorter way, is to divide the area of excavation into unequal rectangles, locating the corners of the rectangles only at those points where the general surface changes, obtaining the average depth of each rectangle, as before, and multiplying by its area will give the cubic feet; adding together the cubic feet contained in all the rectangles thus obtained, will give the cubic feet in the entire excavation.

A cubic yard of earth before digging will occupy about $1\frac{1}{3}$ or $1\frac{1}{2}$ cubic yards when dug, and will average 21 cubic feet to the ton; sand, 22 feet; clay, 18 feet; and gravel, 19 cubic feet to the ton.

Grading and terracing are estimated by the square yard, giving an approximate depth of the excavating or filling required.

Soiling and sodding are estimated by the square yard.

COST.

The cost of excavating depends on rate of laborer's wages per day, the nature of the soil and the distance of cartage; it varies greatly in different parts of the country, averaging about 30 cents for general, and about 40 cents per cubic yard for trench excavation.

COST OF GENERAL EXCAVATION IN DIFFERENT CITIES.

Washington, D. C.	23 cts.	Baltimore, Md., in 1881	18 cts.
Montgomery, Ala., in 1881	25 "	Austin, Tex., in 1880	39 "
Hannibal, Mo., in 1884	12 "	Syracuse, N. Y., in 1884	30 "
Wichita, Kan., in 1886	15 "	St. Joseph, Mo., in 1885	35 "
Lynchburg, Va., in 1885	44 "	Leavenworth, Kan., in 1885	25 "

COST OF TRENCH EXCAVATION.

Wichita, Kan., in 1886	25 cts.	Paducah, Ky., in 1882	50 cts.
Nebraska City, Neb., in 1886	23 "	Louisville, Ky., in 1885	48 "
Lynchburg, Va., in 1885	65 "		

The cost of soiling and sodding varies from 8 cents to 15 cents per square yard.

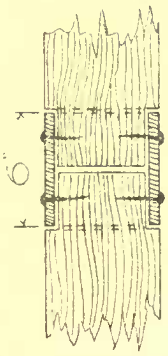
Piling. — The piling should be shown on the drawing for foundations, the distances from centres (not less than $2\frac{1}{2}$ feet), should be figured, and the locations properly shown; and where any portion of the foundation requires longer piles than another, the lengths of the piles for the different portions should be definitely shown and figured.

The methods used for determining the weights piles will carry do not differ from those in ordinary practice, and as it is not intended to give calculations for strains, etc., in these articles, need not be considered here, except to say, that where piles are driven to hard-pan, their resistance or bearing capacity is calculated the same as for posts. Where their resistance depends upon friction against the sides, and this is by far the most common case for piles, the best established rule for determining the safe load on each pile is: Multiply the weight of the ram in pounds by the height of fall in inches, and divide the product by the set in inches at the last blow (assuming that a factor of 8 is sufficient), one-eighth of the above result will be the safe load in pounds on each pile.

Although the above rule is the one most commonly used and generally accepted, it is not always reliable. An experienced engineer, who has driven miles of piles for railroads, piers and buildings, says he has spent much time in experimenting and trying to formulate a reliable rule for all kinds of soils, but so far has not succeeded; and considers the safest guide is to follow the judgment of experienced pile-drivers in each locality after careful tests have been made on the site.

Piles may be of white-oak, pine, spruce or hemlock, preference being in the order mentioned, and may be from 10 inches to 15 inches diameter at the butt, when 25 feet long and under, and 15 inches to 18 inches diameter for piles 30 feet long and over.

After the general and trench excavation has been made, the piles are to be driven in the trenches in the positions shown on the plans.



Where hard-pan can be reached, the piles are to be shod with cast-iron shoes, and driven to a firm bearing-using followers or false piles if necessary; the false piles to be connected to tops of others by wrought-iron cylinders 6 inches long, securely spiked to end of each pile; where the head of pile cannot be driven to bottom of trench, it is to be cut off horizontally at that level. The heads so cut off to be the property of the contractor, and must be removed from the premises.

Where hard-pan cannot be reached, the piles to be driven until a ram weighing [blank] pounds, falling [blank] feet, will not drive the pile more than [blank] inches at the last blow (3 or more test blows to be given).

All piles to have wrought-iron rings, the full diameter of piles (2″ x $\frac{3}{8}$″ section of metal) at top to prevent splitting the piles by the blows of the ram, and to be connected longitudinallyand transversely by heavy timbers of width equal to diameter of pile, securely spiked or pinned into head of pile. Where piles are exposed to sea-water, they should be creosoted, coated with asphalt, or best of all, covered with copper to protect them from limnoria, ship-worms, etc.

DRIVING AND COST.

At Baltimore in 1881, pine piles 10 inches to 15 inches diameter at butt were driven until a 1200 pound ram falling 20 feet, drove the pile only $\frac{3}{4}$ inch at last blow, and cost furnished and driven: 6 feet long, \$3.20 each; 10 feet long, \$3.75; 15 feet long, \$4.25; 20 feet long, \$4.75; and 25 feet long, \$5.25.

At Pittsburg in 1881, pine piles 12 inches to 15 inches diameter, and 15 feet, 20 feet and 25 feet long were driven until a 2400 pound ram falling 15 feet drove the pile $\frac{3}{4}$ inch at last blow; and piles 15 inches to 18 inches diameter, 30 feet, 35 and 40 feet long were driven until a 3000 pound ram falling 15 feet drove pile only 1 inch at last blow; and they cost 15 feet long, \$10.70 each; 20 feet long, \$13.60; 25 feet long, \$16.50; 30 feet long, \$19.40; 35 feet long, \$22.00; and 40 feet long, \$24.80.

For wharf at Charleston, S. C., creosoted yellow-pine piles, 12 inches diameter, 40 feet long were driven, until a 3000 pound ram falling 20 feet, drove pile only $2\frac{1}{2}$ inches at last blow (3 test blows given), and cost \$15.75 each.

At Council Bluffs, Ia., in 1884, pine piles 12 inches diameter, 16 feet long, cost, \$2.00 and \$2.25 each, and 16 cents per lineal foot driven, making about \$4.80 per pile driven.

Sheet or sheath piles are thin timbers driven in contact, filling the gaps between gauge piles, and are used in shoring up for excavations, bulkheading, etc.; they are from 2 inches to 4 inches thick, sharpened at end, and sometimes tongued and grooved, and have wrought-iron cap, which is removed after pile is driven; a guide timber is secured on top of the gauge piles, and the sheet piles driven down by it, and securely spiked thereto.

Sheet piling is estimated by the lineal foot, giving height and thickness of piles.

At Brooklyn, in 1885, sheet piling 2 inches thick, 11 feet high, cost per lineal foot \$2.50, furnished and driven, and \$1.40 if removed by contractor after six months. JAS. E. BLACKWELL.

[To be continued.]

THE FRENCH TO EXCAVATE AT DELPHI.— M. Montholon, the French Minister, has concluded the negotiations commenced by his predecessor, Count de Mouy, who was an enthusiast on the subject of antiquities. As a result of their efforts Greece has given to France permission to excavate at Delphi for remains of the Temple.

SAFE BUILDING.—XIV.[1]

GRAPHICAL METHOD.

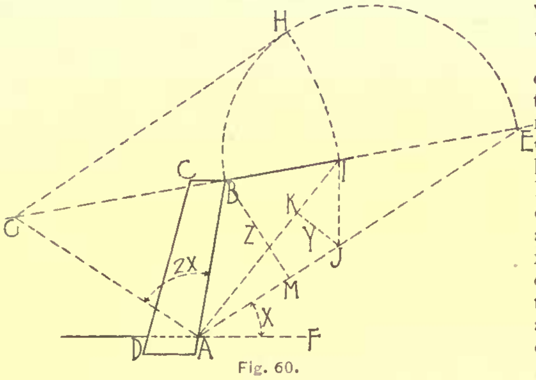


Fig. 60.

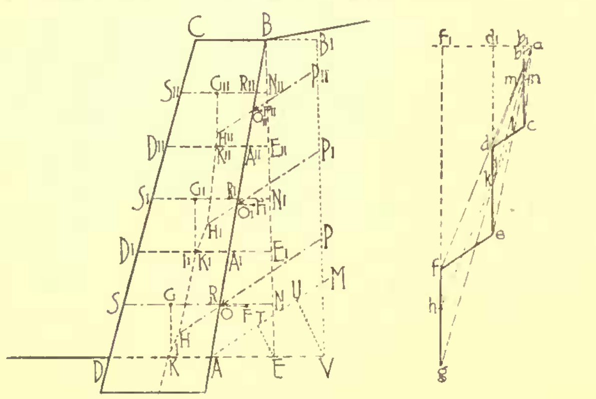
The graphical method of calculating retaining-walls is much easier than the analytical, being less liable to cause errors, and is recommended for office use, though the analytical method might often serve as a check for detecting errors, when undertaking important work.

If A B C D is the section of a retaining wall and B I the top line of backing, draw angle F A M = x = the angle of friction, usually assumed at 33° (except for water); continue B I to its intersection at E with A M; over B E draw a semi-circle, with B E as diameter; make angle B A G = 2 x (usually 66°), continuing line A G till it intersects the continuation of B I at G; draw G H tangent to semi-circle over B E; make G I = G H; draw I A, also I J parallel to B A; draw J K at right angles to I A; and B M at right angles to A E. Now for the sake of clearness we will make a new drawing of the wall A B C D in Figure 61.

Calling B M = Z and K J = Y (both in Figure 60) make A E = Q (Figure 61) where Q is found from formula (57) following: —

$$Q = \frac{Y.Z.s}{L.m} \qquad (57)$$

Where Q = the length of A E in Figure 61, in feet,
Where Y = the length of K J in Figure 60, in feet,[2]
Where Z = the length of B M in Figure 60, in feet,
Where s = the weight of one cubic foot of backing, in lbs.
Where m = the weight of one cubic foot of wall, in lbs.
Where L = the height of backing, in feet, at wall.



Figs. 61 and 62.

Sections must have equal heights. Draw E B, divide the wall into any number of sections of *equal height*, in this case we will say three sections, A $A_{,}$ $D_{,}$ D; $A_{,}$ $A_{,,}$ $D_{,,}$ $D_{,}$ and $A_{,,}$ B C $D_{,,}$. Find the centres of gravity of the different parts, viz.: G, $G_{,}$ and $G_{,,}$, also F, $F_{,}$ and $F_{,,}$. Bisect D $D_{,}$ at S, also $D_{,}$ $D_{,,}$ at $S_{,}$ and $D_{,,}$ C at $S_{,,}$. Draw S N, $S_{,}$ $N_{,}$ and $S_{,,}$ $N_{,,}$ horizontally. Through G, $G_{,}$ and $G_{,,}$ draw vertical axes, and through F, $F_{,}$ and $F_{,,}$ horizontal axes, till they intersect A B at O, $O_{,}$ and $O_{,,}$. Draw O P, $O_{,}$ $P_{,}$ and $O_{,,}$ $P_{,,}$ parallel to M A, where angle M A E = x = angle of friction of soil, or backing. In strain diagram Figure 62 make a $b_{,}$ = $R_{,,}$ $N_{,,}$; also $b_{,}$ $d_{,}$ = $R_{,}$ $N_{,}$ and $d_{,}$ $f_{,}$ = R N. From $b_{,}$, $d_{,}$ and $f_{,}$ draw the vertical lines. Now begin at *a*; draw *a b* parallel to M A; make *b c* = $S_{,,}$ $R_{,,}$; draw *c d* parallel to M A; make *d e* = $S_{,}$ $R_{,}$; draw *e f* parallel to M A and make *f g* = S R. Draw *a c*, *a d*, *a e*, *a f* and *a g*. Now returning to Figure 61, prolong $P_{,,}$ $O_{,,}$ till it intersects the vertical axis through $G_{,,}$ at $H_{,,}$; draw $H_{,,}$ $H_{,}$ parallel to *a c* till it intersects $P_{,}$ $O_{,}$ at $H_{,}$; draw $H_{,}$ $I_{,}$ parallel to *a d* till it intersects the vertical axis through $G_{,}$ at $I_{,}$; draw $I_{,}$ H parallel to *a e* till it intersects P O at H; draw H I parallel to *a f* till it intersects the vertical through G at I; draw I K parallel to *a g*. Then will points K, $K_{,}$ and $K_{,,}$ be points of the curve of pressure. The amount of pressure at $K_{,,}$ will be *a c*, at $K_{,}$ it will be *a e*, and at K it will be *a g*, from which, of course, the strains on the edges D, $D_{,}$ and $D_{,,}$, also A, $A_{,}$ and $A_{,,}$ can be calculated by formulæ (44) and (45). To obtain scale, by which

Scale of strain diagram. to measure *a c*, *a e* and *a g*, make *g h*, Figure 62 at any scale equal to the weight, in pounds, of the part of wall A $A_{,}$ $D_{,}$ D one foot thick, draw *h i* parallel *f a*, then *g i* measured at same scale as *g h*, is the amount of pressure, in pounds, at K. Similarly make *e k* = weight of centre part, and *c m* = weight of upper part, draw *k l* parallel *d a*, and *m n* parallel *b a*, then is *e l* the pressure at $K_{,}$ and *c n* the pressure at $K_{,,}$, both measured at same scale; or a still more simple method would be to take the weight of A $A_{,}$ $D_{,}$ D, in pounds, and one foot thick, and divide this weight by the length of *g f* in inches; the result being the number of pounds per inch to be used, when measuring lengths, etc., in Figure 62. The above graphical method is very convenient for high walls, where it is desirable to examine many joints, but *care must be taken to be sure to get the parts all of equal height*, otherwise, the result would be incorrect.

If backing loaded. In case of a superimposed weight find $w_{,,}$ as directed in formula (55), make A T at any scale equal to *w* and A U = $w_{,,}$, draw T E and parallel thereto U V, draw V $B_{,}$ parallel to E B and use V $B_{,}$ in place of E B, proceeding otherwise as before. The points O of application of pressure P O, will be slightly changed, particularly in the upper part, as they will be horizontally opposite the centres of gravity of the enlarged trapezoids, and in the upper case this point would be much higher, the figure now being a trapezoid, instead of a triangle as before.

Buttressed walls. Where a wall is made very thin and then buttressed at intervals, all calculations can be made the same as for walls of same thickness throughout, but the vertical axis through centre of gravity of wall should be shifted so as to pass through the centre of gravity of the whole mass, including buttresses; and the weight of thin part of wall should be increased proportionately to the amount of buttress, thus: If a 12″ wall is buttressed every 5 feet (apart) with 2′ x 2′ buttresses, proceed as follows:

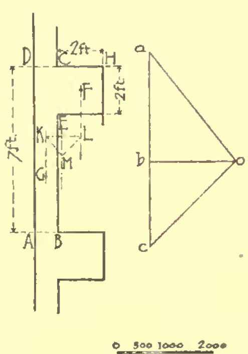


Fig. 63.

Find the centre of gravity G of the part of wall A B C D (in plan) Figure 63, also centre of gravity F of part E I H C, draw lines through F and G parallel to wall. Now make *a b* parallel to wall and at any scale equal to weight or area of A B C D and *b c* equal to that of E I H C. From any point *o* draw the lines *o a*, *o b* and *o c*; now draw K L (anywhere between parallel lines F and G), but parallel to *b o*, and from L draw L M parallel to *o c*, and from K draw K M parallel to *a o*, a line through their point of intersection M drawn parallel to wall is the neutral axis of the whole mass. When drawing the vertical section of wall-part A B C D, Figure 64, therefore, instead of locating the neutral axis through the centre of wall it will be as far outside as M is from B C, in Figure 63; that is, at G H, Figure 64.



Fig. 64.

When considering the weight per cubic foot of wall, we add the proportionate share of buttress; now in Figure 63 there are 4 cubic feet of buttress to every 7 feet of wall, so that we must add to the usual weight *w* per cubic foot of wall $\frac{4}{7}w$, or $w.(1+\frac{4}{7})$

To put this in a formula.

$$w_{,,} = w \cdot (1 + \frac{a}{a_{,}}) \qquad (58)$$

[1] Continued from No. 584, page 117.

[2] If the incline of line B I to the horizon is equal to the angle of friction, as is often the case, find A G as before and use this length in place of K J or Y, which, of course, it will be impossible to find, as A M and B I would be parallel and would have no point of intersection; of course, B I can never be steeper than A M, or else all of the soil steeper than the line of angle of friction would be apt to slide.

Glossary of Symbols.—The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.: —

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_1 = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
𝔡 = *diameter*, in inches.
𝔯 = *radius*, in inches.
π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{I}, a_{II}, a_{III}, etc., or b, b_{I}, b_{II}, b_{III}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance: —

m = moment or bending moment at *centre*.
m_A = " " " *point A*.
m_B = " " " *point B*.
m_X = " " " *point X*.
s = strain at *centre*.
s_B = " *point B*.
s_X = " *point X*.
v = stress at *centre*.
v_D = " *point D*.
v_X = " *point X*.
w = load at *centre*.
w_A = " *point A*.

Where $w_{,,}$ = the weight per cubic foot, in pounds, to be used for buttressed walls, after finding the neutral axis of the whole mass.

Where w = the actual weight, in pounds, per cubic foot of the material.

Where A = the area in square feet of one buttress.

Where $A_{,}$ = the area in square feet of wall from side of one buttress to same side of next buttress.

Walls with counterforts. The buttresses, however, will not be of very much value, unless they are placed quite close together. Buttresses on the back surface of a wall are of still less value, unless thoroughly bonded and anchored to walls; these latter are called counterforts. It is wiser and cheaper in most cases to use the additional masonry in thickening out the lower part of wall its entire length.

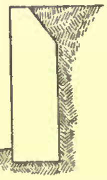


Fig. 65.

Resistance to frost. Where frost is to be resisted the back part of wall should be sloped, for the depth frost is likely to penetrate (from 3 to 4 feet in our climate), and finished smoothly with cement, and then asphalted, to allow the frozen earth to slide upwards, see Figure 65.

Example I.

Cellar wall to frame dwelling. *A two story and attic frame house has a 12″ brick foundation wall, the distance from cellar bottom to ground level being 6 feet. The angle of friction of ground to be assumed at 33° and the weight per cubic foot at 120 pounds. Is the wall safe?*

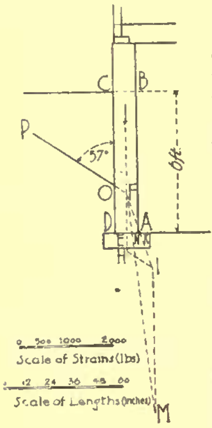


Fig. 66.

The weight of wall and superstructure must, of course, be taken at its minimum, when calculating its resistance to the ground, we shall, therefore, examine one of the sides on which no beams or rafters rest. The weight will consist, therefore, only of brick wall and frame wall over. We examine only one running foot of wall, and have

8 cubic feet of brick at 112 lbs.	=	896 lbs
24 feet (high) of frame wall at 15 lbs.	=	360 "
Total weight resisting pressure	=	1256 "

The pressure itself will be according to formula (52)

$$p = 16\tfrac{2}{3}.\ L^2 = 16\tfrac{2}{3}.\ 36$$
$$= 600 \text{ lbs.}$$

Now make D O = ⅓. D C. Make angle P O C = 57°; prolong P O till it intersects the vertical neutral axis of wall[1] at F; make F H = 1256 pounds, at any scale, draw H I parallel to P O, and make H I = p = 600 pounds at same scale. Draw I F, then is its point of intersection K (with D A) a point of the curve of pressure, and F I (measured at same scale) is the amount of pressure p to be used in formulæ (44) and (45). By careful drawing we will find that K comes ½″ beyond A (outside of A D), or 6½″ from centre E of A D. F I we find measures 1660 units, therefore p = 1660 pounds.

To find the actual stress or resistance v of edge of fibres of brickwork at A use (44), viz:

$$v = \frac{p}{a} + 6.\ \frac{x.p}{a.d}$$

and as p = 1660 and x = E K = 6½″ and a = 12. 12 = 144 inches and d = A D = 12″ we have:

$$v = \frac{1660}{144} + 6.\ \frac{6\frac{1}{2}.\ 1660}{144.\ 12} = 11\tfrac{1}{2} + 37\tfrac{1}{2} = +\ 49 \text{ pounds}$$

as this is a positive quantity it will be compression.

The resistance of edge-fibres at D will be according to formula (45)

$$v = \frac{1660}{144} - 6.\ \frac{6\frac{1}{2}.\ 1660}{144.\ 12} = 11\tfrac{1}{2} - 37\tfrac{1}{2} = -\ 26 \text{ pounds}$$

as this is a negative quantity D will be subjected to tension; that is, there is a tendency for A B C D to tip over around the point A, the point D tending to rise. The amount of tension at D is more than ordinary brickwork will safely stand, according to Table V, still, as it would only amount to 26 pounds on the extreme edge-fibres and would diminish rapidly on the fibres nearer the centre, we can consider the wall safe, even if of but fairly good brickwork, particularly as the first-story beams and girders and the end and possible cross-walls, will all help to stiffen the wall. Had we taken a foot-slice of the wall under the side carrying the beams, we should have had an additional amount of weight resisting the pressure. If the beams were 18 ft. span, we should have three floors each 9 ft. long and with load weighing, say, 90 pounds per foot; to this must be added the roof, or about 13 ft. à 50 pounds, the additional load being:

Floors,	3. 9. 90 =	2430
Roof,	13. 50 =	650
Total		3080

Now make I M = 3080 pounds at same scale as F H, etc., draw M F and its point of intersection N with D A would be a point of the curve of pressure, and F M, at same scale the amount of pressure on D A for the bearing walls of house; E N we find measures 2½″, and F M measures 4600 units or pounds. The stress at A, then, would be:

$$v = \frac{4600}{144} + 6.\ \frac{2\frac{1}{2}.\ 4600}{144.\ 12} = +\ 72 \text{ pounds.}$$

and the stress at D would be:

$$v = \frac{4600}{144} - 6.\ \frac{2\frac{1}{2}.\ 4600}{144.\ 12} = -\ 8 \text{ pounds.}$$

There will, therefore, be absolutely no doubt about the safety of bearing walls.

Example II.

Cellar wall deeper than adjoining building. *A cellar wall A B C D is to be carried 15 feet below the level of adjoining cellar; for particular reasons the neighboring wall cannot be underpinned. It is desirable not to make the wall A B C D over 2′ 4″ thick. Would this be safe? The soil is wet loam.*

In the first place, before excavating we must sheath-pile along line C D, then as we excavate we must secure horizontal timbers along the sheath-piling and brace these from opposite side of excavation. The sheath-piling and horizontal timbers must be built in and left in wall. The braces will have to be built around and must not be removed until the whole weight is on the wall.

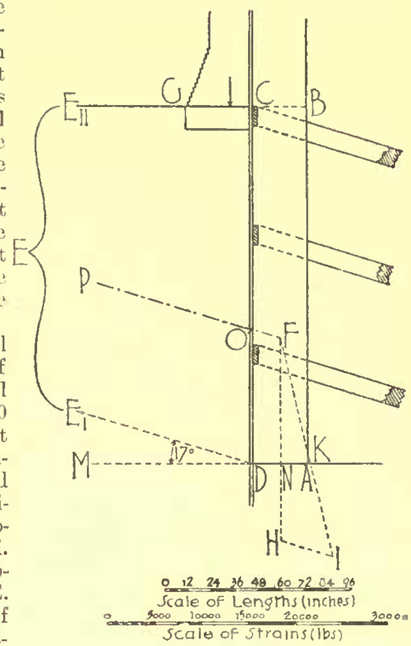


Fig. 67.

The weight of the wall C G, per running foot of length, including floors and roofs, we find to be 13000 pounds, but to this we must add the possible loads coming on floors, which we find to be 6000 pounds additional, or 19000 pounds total, possible maximum load. This load will be distributed over the area of C D E. In calculating the weight of A B C D resisting the pressure, we must take, of course, only the minimum weight; that is, the actual weight of construction and omit all loads on floors, as these may not always be present. The weight of walls and unloaded floors coming on A B C D, and including the weight of A B C D itself, we find to be 21500 pounds per running foot. Now to find the pressure p, proceed as follows: Make angle $E_{,}$ D M = 17°, the angle of friction of wet loam (See Table X), and prolong D $E_{,}$ till it intersects C $E_{,,}$ at E. Now C E, we find, measures 52 feet; C D or L is 15 feet; then, instead of using w in formula (51), we must use $W_{,,}$ as found from formula (55), viz.:

$$w_{,} = w + \frac{2.\ 19000}{CE.\ L}$$

w for wet loam (Table X) is 130 pounds; therefore,

$$w_{,} = 130 + \frac{2.\ 19000}{52.\ 15} = 130 + 48,\ 7 = 179.$$

Inserting this value for w in formula (51) we have:

$$p = 179.\ 15^2.\ 0,\ 138 = 5558.$$

The height X from D of which P O is applied is found from formula 56, and is:

$$X = \frac{15.\ (179 - \frac{2}{3}.\ 150)}{2.179 - 150} = \frac{15.\ (179 - 100)}{358 - 150} =$$

5′,697 = 5′ — 8¼″

Make D O = X = 5′ — 8¼″; draw P O parallel to E D till it intersects the vertical neutral axis of wall (centre line) at F; make F H (vertically) at any scale equal to 21500, draw H I parallel to P O and make H I = p = 5558 pounds at same scale, draw I F, then is its point of intersection with the prolongation of A D at K a point of the curve of pressure, and F I measured at same scale as F H is the amount of pressure on joint. The distance K from centre of joint N we find is 14½″, F I measures 23800 units or pounds; the stress (v) at A, therefore, will be, formula (44):

$$v = \frac{23800}{28.12} + 6.\frac{14\frac{1}{2}.\ 23800}{28.12.28} = +\ 292$$

While the stress at D would be formula (45)

$$v = \frac{23800}{28.12} - 6.\frac{14\frac{1}{2}.23800}{28.12.28} = -\ 150$$

Or the edge at A would be subjected to a compression of 292 pounds, while the edge at D would be submitted to a tension of 150 pounds per square inch, both strains much beyond the safe limit of even the best masonry. The wall will, therefore, have to be thickened and a new calculation made.

Example III.

Wall to stage pit. *A stage pit 30 feet deep is to be enclosed by a stone-wall, 3 feet thick at the top and increasing 4 inches in thickness for every 5 feet of depth. The wall, etc., coming over this wall weighs 25000 pounds per running foot, but cannot be included in the calculation, as peculiar circumstances will not allow braces to be kept against the cellar wall, until the superimposed weight is on it. The*

[1] It should really be the vertical neutral axis of the whole weight, which would be a trifle nearer to D C than centre of wall.

surrounding ground to be taken as the average, that is, 120 *pounds weight per cubic foot, and with an angle of friction of* 33°.

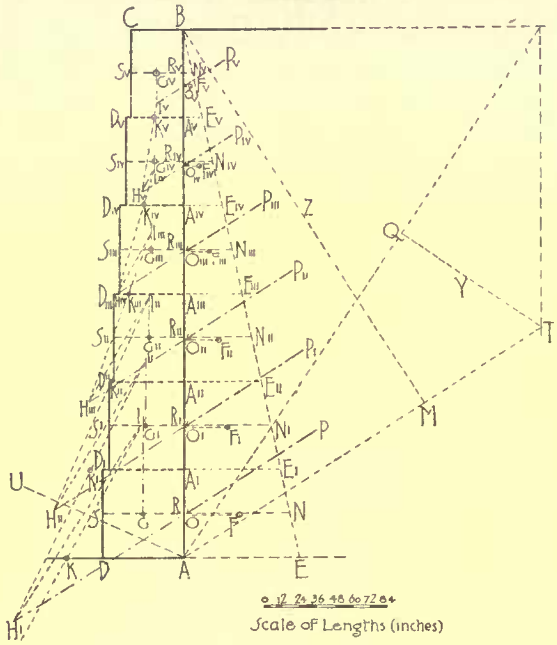


Fig. 68.

Find B M (= Z) and Q T (= Y) by making angles T A E = 33° and B A U = 66° and then proceeding as explained for Figure 60. We scale B M and Q T at same scale as height of wall A B is drawn, and find:

B M = Z = 25 ft. 6″ = 25½

Q T = Y = 9 ft. 8″ = 9⅔; assuming each cubic foot of wall to weigh 150 pounds we find Q from Formula (57)

$$Q = \frac{9\frac{2}{3} \cdot 25\frac{1}{2} \cdot 120}{30 \cdot 150} = 6{,}573 = 6' - 7''.$$

Make A E = Q = 6′ — 7″ and draw B E.

At *equal heights*, that is, every 5 feet, in this case, draw the joint lines D E, D_i E_i, D_{ii} E_{ii}, etc. Find the centres of gravity F, F_i, F_{ii}, etc., of the six parts of A E B, (see foot-note, p. 117) and also the centres of gravity G, G_i, G_{ii}, etc., of the six parts of the wall itself, which, in the latter case, will be at the centre of each part.

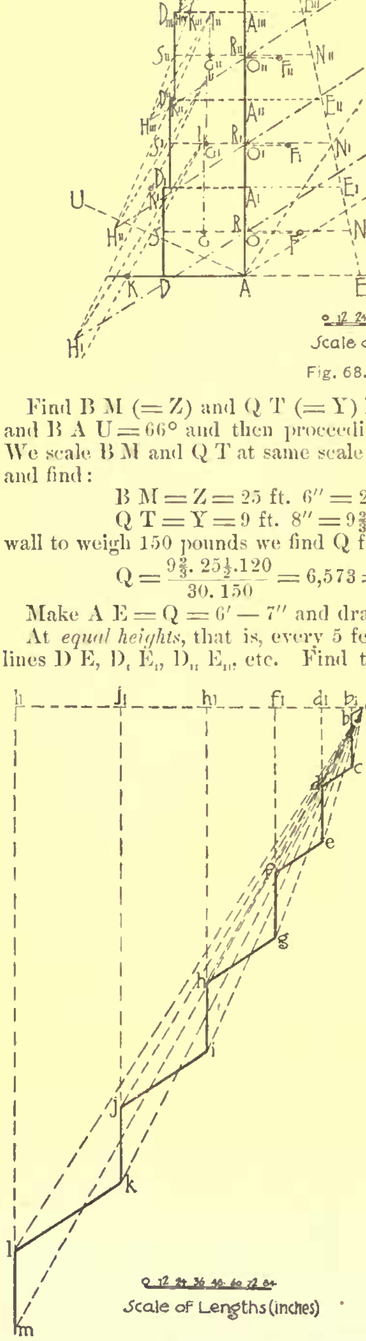


Fig. 69.

Horizontally, opposite the centres F, F_i, F_{ii}, etc., apply the pressures P O, P_i O_i, etc., against wall, and parallel to M A. Through centres G, G_i, G_{ii}, etc., draw vertical axes.

Draw the lines S N, S_i N_i, S_{ii} N_{ii}, etc., at half the vertical height of each section. Now in Figure 69 make $a\, b_i = R_v\, N_v$; $b_i\, d_i = R_{iv}\, N_{iv}$; $d_i\, f_i = R_{iii}\, N_{iii}$; $f_i\, h_i = R_{ii}\, N_{ii}$; $h_i\, j_i = R_i\, N_i$; and $j_i\, l_i = R\ N$. Draw the vertical lines through these points. Now begin at *a*, make *a b* parallel to P O, make $b\, c = R_v\, S_v$; draw *c d* parallel P O; make $d\, e = R_{iv}\, S_{iv}$; draw *e f* parallel P O, make $f\, g = R_{iii}\, S_{iii}$, and similarly *g h*, *i j* and *k l* parallel P O, and $h\, i = R_{ii}\, S_{ii}$; $j\, k = R_i\, S_i$ and $l\, m = R\ S$. Draw from *a* lines to all the points *c*, *d*, *e*, *f*, *g*, etc. Now in Figure 68 begin at P_v O_v, prolong it till it intersects vertical axis G_v at I_v, draw I_v H_v parallel *a c* till it intersects P_{iv} O_{iv} at H_v; draw H_v I_{iv} parallel to *a d* till it intersects vertical axis G_{iv} at I_{iv}; draw I_{iv} H_{iv} parallel to *a e* till it intersects P_{iii} O_{iii} at H_{iv} and similarly H_{iv} I_{iii} parallel *a f*; I_{iii} H_{iii} parallel *a g:* H_{iii} I_{ii} parallel *a h;* I_{ii} H_{ii} parallel to *a i;* H_{ii} I_i parallel to *a j;* I_i H_i parallel to *a k;* H_i I parallel to *a l*, and I K parallel to *a m.*

The points of intersection K, K_i, K_{ii}, etc., are points of the curve of pressure. To find the amount of the pressure at each point, find weight per running foot of length of any part of wall, say, the bottom part (A A_i D_i D) the contents are 5′ high, 4′ 8″ wide, 1′ thick = 5.4⅔.1 = 23⅓ cubic feet à 150 pounds

= 3500 pounds.

Divide the weight by the length of *m l* in inches, and we have the number of pounds per inch, by which to measure the pressures. As *m l* measures 56 inches, each inch will represent $\frac{3500}{56} = 62\frac{1}{2}$ lbs.

Now let us examine any joint, say, A_{iii} D_{iii}; I_{iii} H_{iii} which intersects A_{iii} D_{iii} at K_{iii} is parallel to *a g*. Now *a g* scales 166 inches, therefore, pressure at $K_{iii} = 166 \cdot 62\frac{1}{2} = 10375$ pounds. In measuring the distance of K_{iii} from centre of joint in the following, remember that the width of A_{iii} D_{iii} is 44 inches, the width of masonry above joint, and *not* 48″ (the width of masonry below). A_{iii} K_{iii} scales 38″, therefore, distance *x* of K_{iii} from centre of joint is $x = 38 - 22 = 16''$.

We have, then, from Formula (44)

$$\text{stress at } D_{iii};\ v = \frac{10375}{44.12} + 6.\frac{16.10375}{44.12.44} = +63 \text{ pounds.}$$

and from formula (45)

$$\text{stress at } A_{iii};\ v = \frac{10375}{44.12} - 6.\frac{16.10375}{44.12.44} = -23 \text{ pounds.}$$

The joint A_{iii} D_{iii}, therefore, would be more than safe.

Let us try the bottom joint A D similarly. I K is parallel to *a m;* now *a m* scales 480″, therefore, the pressure at K is $p = 480 \cdot 62\frac{1}{2} = 30000$ pounds.

Now K is distant 53 inches from centre of joint, therefore, stress at D is $v = \frac{30000}{56.12} + 6.\frac{53.30000}{56.12.56} = +298$ pounds.

and stress at A is $v = \frac{30000}{56.12} - 6.\frac{53.30000}{56.12.56} = -209$ pounds.

The wall would evidently have to be thickened at the base. If we could only brace the wall until the superimposed weight were on it, this might not be necessary. If we could do this we should lengthen *b c* an amount of inches equal to the amount of this load divided by 62½ (the number of pounds per inch), or *b c* instead of being 36 inches long would be:

$$36 + \frac{25000}{62\frac{1}{2}} = 436 \text{ inches long.}$$

While this lengthening of *b c* would make the lines of pressure *a c*, *a e*, *a f*, etc., very much longer, and consequently the actual pressure very much greater, it will also make them very much steeper and consequently bring this pressure so much nearer the centre of each joint, that the pressure will distribute itself over the joint much more evenly, and the worst danger (from tension) will probably be entirely removed.

Example IV.

Reservoir Wall. *A stone reservoir wall is plumb on the outside,* 2 *feet wide at the top and* 5 *feet wide at the bottom; the wall is* 21 *feet high, and the possible depth of water* 20 *feet. Is the wall safe?*

Divide the wall into three parts in height; that is, D D_i = D_i D_{ii} = D_{ii} C. Find the weight of the parts from each joint to top, per running foot of length of wall, figuring the stonework at 150 pounds per cubic foot, and we have:

Weight of A_{ii} B C D_{ii} = 2975 pounds.

Weight of A_i B C D_i = 7140 pounds.

Weight of A B C D = 12495 pounds.

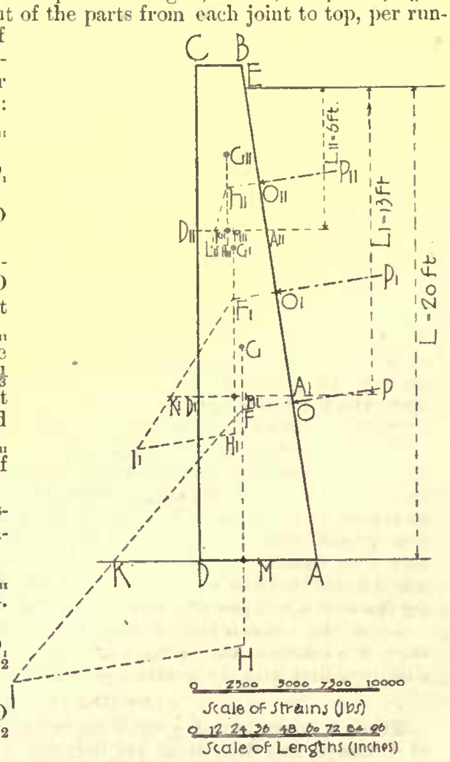


Fig. 70.

Find centres of gravity of the parts A B C D (at G), of A_i B C D_i (at G_i) and of A_{ii} B C D_{ii} (at G_{ii}). Apply the pressures P O at ⅓ height of A E; P_i O_i at ⅓ height of A_i E and P_{ii} O_{ii} at ⅓ height of A_{ii} E, where E top level of water.

The amount of pressures will be from formula (53).

For part A_{ii} E; $P_{ii}\, O_{ii} = 31\frac{1}{4}.\ L^2_{ii} = 31\frac{1}{4}.\ 6^2 = 1125$ pounds.

For part A_i E; $P_i\, O_i = 31\frac{1}{4}.\ L^2_i = 31\frac{1}{4}.\ 13^2 = 5281$ pounds.

For part A E; $P\ O = 31\frac{1}{4}.\ L^2 = 31\frac{1}{4}.\ 20^2 = 12500$ pounds.

The pressures P O, P_i O_i, etc., will be applied at right angles to A E, prolong these lines, till they intersect the vertical axes through (the centres of gravity) G, G_i and G_{ii} at F, F_i and F_{ii}. Then make

F_{ii} H_{ii} = 2975, weight of upper part.

F_i H_i = 7140, weight of A_i B C D_i, and

F H = 12495, weight of A B C D.

Draw through H, H_i and H_{ii} the lines parallel to pressure lines, making

$H_{ii}\, I_{ii} = P_{ii}\, O_{ii} = 1125$

$H_i\, I_i = P_i\, O_i = 5281$

$H\ I = P\ O = 12500$

Draw I_{ii} F_{ii}, I_i F_i and I F, then will their lengths represent the

amounts of pressure at points $K_{\prime\prime\prime}$, $K_{\prime}$ and K on the joints $A_{\prime\prime}$ $D_{\prime\prime\prime}$, $A_{\prime}$ $D_{\prime}$ and A D.

$F_{\prime\prime}$ $I_{\prime\prime}$ measures 3300 units or pounds.
$F_{\prime}$ $I_{\prime}$ " 9500 " "
F I " 18800 " "

By scaling we find that

$K_{\prime\prime}$ is 10½ inches from centre of $D_{\prime\prime}$ $A_{\prime\prime}$
$K_{\prime}$ is 37 " " $D_{\prime}$ $A_{\prime}$
K is 74 " " D A

The stresses to be exerted by the wall will, therefore, be

$$\text{at } D_{\prime\prime}\,;\ v = \frac{3300}{36.12} + 6.\frac{10\frac{1}{2}.3300}{36.12.36} = +\ 21 \text{ pounds.}$$

$$\text{at } A_{\prime\prime}\,;\ v = \frac{3300}{36.12} - 6.\frac{10\frac{1}{2}.3300}{36.12.36} = -\ 6 \text{ pounds.}$$

$$\text{at } D_{\prime}\,;\ v = \frac{9500}{48.12} + 6.\frac{37.9500}{48.12.48} = +\ 93 \text{ pounds.}$$

$$\text{at } A_{\prime}\,;\ v = \frac{9500}{48.12} - 6.\frac{37.9500}{48.12.48} = -\ 60 \text{ pounds.}$$

$$\text{at D}\,;\ v = \frac{18800}{60.12} + 6.\frac{74.18800}{60.12.60} = +\ 219 \text{ pounds.}$$

$$\text{at A}\,;\ v = \frac{18800}{60.12} - 6.\frac{74.18800}{60.12.60} = -\ 167 \text{ pounds.}$$

From the above it would appear that none of the joints are subject to excessive compression: further that joint $D_{\prime\prime}A_{\prime\prime}$ is more than safe, but that the joints $D_{\prime}$ $A_{\prime}$ and D A are subject to such severe tension that they cannot be passed as safe. The wall should, therefore, be redesigned, making the upper joint lighter and the lower two joints much wider.

LOUIS DECOPPET BERG.

[To be continued.]

HINTS FOR BUILDERS, OR USEFUL INFORMATION FOR BEGINNERS.—I.



IN undertaking the writing of the present series of articles, I have had in view the needs and requirements of the younger members engaged in the building and all the other trades intimately associated therewith — that is to say, the wants of apprentices and other young men who may desire to acquire something more than a mere perfunctory and rule-of-thumb knowledge of their profession, and whose extra knowledge will stand them in right good stead in such a land as the United States, and, although the ground I may traverse may, and possibly will be more or less familiar to many of my elder readers, still such will not be the case with those who have not advanced so far in life or their trade, for whom my papers are particularly written. For such there cannot ever be a beginning, and this being, I think, generally admitted, I have thought it advisable, in this series, to take my readers over the groundwork of the branches of the constructor's work, upon which I shall touch — giving them, in fact, a "wherefore" for a "why." Thus I shall, in the course of these papers, treat, more or less fully of masonry, bricklaying, drainage, mortars and cements, plastering, plumbing, carpentering, joining, flooring, warming, and ventilation, thus, I hope, taking those who may care to follow me — no matter to which branch of the building trade they may belong — over ground which, to become really efficient and intelligent workmen, they should travel, and which, I hope, they will not object to travel hand in hand with myself. With this brief introduction to my readers, I will proceed with my subject.

As in the construction of a house — be it a log hut or a hotel, a store or a mansion, the sanitary arrangements are all important. I shall deal first with the question of drainage.

DRAINAGE.

There is no subject of greater importance to the builder than that of drainage, and there is no question that a building well drained is half built, as on proper sanitary arrangements very much depends, not only as regards the structure itself, but as respects the health of its occupiers also. The question of drainage, beside that of effectually disposing of all sewage and waste water, also embraces irrigation, which is really the science of drainage as applied to land not intended for residental purposes, but as this phase of the question does not concern us, it will suffice to merely mention this fact, and then pass on to a consideration of the question as it affects the builder.

With respect to drainage as applied to sewering purposes, the Romans were undoubtedly far in advance of any other of the ancient nations, in proof of which their well executed and admirably conceived Cloaca Maxima still remains, as sound as the day when first put up, and still serving its original purpose. There is also no question that much valuable property has been lost in throwing the refuse of our towns into tidal rivers, where it has run to waste, beside causing much injury to the fish in the streams, and the inhabitants along their banks; and though we are gradually learning to utilize the sewage of our cities upon our lands, there is but little doubt that a great future is in store for our refuse, and that our rivers will be in days to come as pure and clean as they were wont to be in the oft-quoted "good old times." Of course, it is far easier to pick out defects in the various systems of the present day than to point out remedies, and as we have no wish to be embroiled in a heated controversy respecting the various methods of effective sanitation, we shall refrain from suggesting remedies, but simply confine ourselves to mentioning such things as every one engaged in the building trade should become acquainted with.

In the laying down of sewers, a primary necessity is to see that all the pipes have a proper fall, and this must be continuous, for if this be not done, the sewage, instead of flowing away, as it should do, will collect, and virtually a cesspool will be formed beneath the house, and become especially dangerous to the inhabitants. Of course the inclination and depth of all sewers must vary according to local circumstances and requirements — such as the "lay" of the land, buildings to be erected, and other features — but on no conditions should the fall be less than one-and-one-fourth inches to every ten feet. In laying the sewers for a city (supposing them to be of brick) be it large or small, devoted to residential or manufacturing purposes, the bricks employed in the building thereof should be good, hard, square, thoroughly sound, and well-burnt stock bricks, properly laid in well compounded mortar, the constituents of which should consist of one part of good strong stone lime, and two parts of clean and fine river sand, and the workmanship should invariably be of the best possible description. Should Roman cement be used, it must be of the best quality possible, and not more than half the quantity of clean river sand should be mixed therewith. Where practicable, cast-iron pipes are far preferable to brick-built sewers, owing to leakage being impossible, except at the joints, and not here if the work be properly performed. Brick-built sewers should not be employed, if it can possibly be avoided.

The main sewers receive the drainage of buildings by means of channels known as drains, which are generally of circular form, and varying from six to twenty-four inches in diameter, according to the requirements of the district. The lowest portion of the building to be drained should be as high as possible above the level of the sewer — in the vicinity of rivers, lakes or canals, at least six feet, measuring to the bottom of the side wall or commencement of the invert. If this preliminary precaution be not taken, the premises are liable to be flooded whenever the sewer is more than usually full, and such an accident is even possible when the sewers are flushed by artificial means. The bottoms of all house-drains should be at least twelve inches above the bottom of the sewer into which they run, while the fall should not be less than one-quarter inch for each foot. Thus to take a case in point, as a practical illustration for our younger readers, suppose the length of the house-drain to be sixty feet, the fall would amount to fifteen inches, which added to nineteen inches for the height of the drain itself, and the necessary brickwork, eight inches for the depth of the ground, and the paving over the upper end of the drain, and twelve inches between its lower end and the bottom of the main sewer, will give the total fall of four-and-one-half feet, which will give that for a small private residence. Of course in larger buildings, the dimensions would require to be enlarged. Where it is at all practicable, glazed stoneware or cast-iron pipes should be employed in preference to the brickwork sewers, as they are more easily and quickly laid than the others can be built, they present a much better surface for the rapid flow of the sewage, and they are less liable to leak, as, if properly jointed up, a leakage should be an impossibility. Also, seeing the comparative thinness of these pipes a much larger capacity is obtained, with a given quantity of excavation for laying them than in brickwork sewers, which at the lowest, cannot be less than four inches (half-a-brick) in thickness. Builders should therefore bear this ever in mind.

In designing a house, the architect should see that the water-closets, sinks, and other receptacles for waste water and sewage are at the back of the house, and that the drains are at the back also; but should the drains have to connect with the sewers in the roadway in front of the house, the sanitary arrangements should be so ordered that the drain runs along the passageway or hall, from back to front, and not crosswise or under any of the rooms. The reason for this will at once be obvious, as, should a bursting at any time unfortunately happen, the drains can be got at and the damage rectified without much disorder. All the sockets of drain-pipes should be hermetically joined, in order that no foul gases may escape into the house, and with this object only the very best cements should be employed on this, the most important part of the work.

An important matter to be borne in mind by the builder is that all sinks and gully-holes must be trapped, in order that the foul gases evolved from the putrid substances in the pipes should not be permitted to escape into the air outside or inside the building: as there are a variety of more or less efficient traps in the market, we must leave the choice of them to the builder, impressing upon him the necessity for their use, their perfect fitting and their simple construction. The majority of them depend for their action upon what is known as a water-seal, but there are many beside these somewhat old-fashioned but decidedly efficacious traps.

In laying down sewers, curves should be avoided, and that for two reasons: matters may become lodged in corners or bends, thus causing a stoppage and possible bursting of the pipes; and secondly, on account of bad jointing-up of the sockets by careless workmen, which would allow the matters to escape, to the certain damage of the surroundings. The fall should be direct and gradual, without any level stretches in it, to allow of a continuous and free passage of the sewage matter; the pipes, be they iron or glazed earthenware — the latter for preference — should be used in all cases where possible, in lieu of a brick-built sewer; and, lastly, care should be exercised that no faulty or cracked pipes are put down, while the best workmanship should always be put into drainage work, so far as it applies to the sewering of cities and houses.

All drains should be so laid that they can be easily got at, and so that it shall not, except under very extraordinary circumstances, be necessary to pull up any flooring in the house other than the passage-way, or to knock down any portion of the structure. Of course there are times when these contingencies cannot possibly be avoided, but if all drains are run beneath the passages or hall-ways of houses, and laid at right-angles, the minimum of inconvenience, should it be necessary at any period to open them, will have been attained; while a little attention and care, when planning the drainage of a new district, combined with a study of the architect's plans, which are generally available, will enable the work to be done properly and finally, instead of being pitchforked down anywhere and anyhow, as is too often the case with careless and ignorant workmen, who imagine that when they have laid the pipes down a certain distance in the soil, they have done all that is necessary. Finally, all rain, closet and bath pipes must be so trapped that the water easily runs down, but that the bad air will not come up, and it is a good plan to run such pipes to the tops of the buildings. But I shall have somewhat to say of this later. If our young workmen will only pay attention to the succeeding wrinkles, they will have no cause to regret it in the course of their working lives. W. N. BROWN.

[To be continued.]

SOCIETIES

BOSTON SOCIETY OF ARCHITECTS. — GENERAL REGULATIONS OF THE ROTCH TRAVELLING SCHOLARSHIP FOR EXAMINATION, 1887.

THE Rotch Travelling Scholarship was founded by the children of the late Benjamin S. Rotch, in pursuance of their father's intention of founding such a scholarship during his lifetime. The direction of these examinations for this scholarship has been intrusted, by the Trustees of this Scholarship, to the Boston Society of Architects, under certain conditions. The committee holds the examinations yearly.

The successful candidate in each yearly examination will receive from the trustees of this Scholarship annually, for two years, $1,000, to be expended in foreign travel and study; provided always, that the beneficiary shows such fitness and diligence as may be required of him.

Candidates must be under thirty years of age, and must have worked during two years with an architect resident in Massachusetts. The committee of the Boston Society of Architects having in charge the examination for the Scholarship invite candidates to be present at the Boston Museum of Fine Arts on April 7, 1887, at 9 A. M. A problem in design will be given to all candidates, and they will be required to make a preliminary sketch for it at the time. The authors of satisfactory sketches will be allowed one month for their development — all the essential features of the scheme being retained — into finished geometric drawings, rendered in color with projected shades. An accurate perspective of the finished elevations must be drawn in line. The set of drawings must be accompanied by a thesis explaining the principles of architecture, historical and æsthetic, which governed the choice and development of the design. Authors of the selected preliminary sketches will be required to pass examinations on the following subjects:

First. History of Architecture and of Arts immediately connected with it.
Second. An elementary knowledge of the French language.
Third. Perspective and projection of shades and shadows.
Fourth. Construction, theory and practice.
Fifth. Free-hand drawing from the cast. A six-hours' study will be required.

The committee make the following suggestions for the help of students preparing themselves for examination. In studying the History of Art, that they should read Lübke's "*History of Art*," Fergusson and Rosengarten's works on Architecture; in the French language, to exercise themselves in reading at sight portions of Viollet-le-Duc's writings; in perspective, the treatises of Professors Ware and S. E. Warren, and Ruskin's "*Elements of Perspective.*"

In construction, familiarity with ordinary practical construction in wood, iron, and masonry, and computation of the strength of materials, are expected of the students.

"*Notes of Building Construction*," of the South Kensington series; Green's "*Graphics*"; and Clark's "*Building Superintendence*," — are recommended by the committee.

In a total of 175, architectural design will count for 100; construction and perspective, 30; architectural history, 20; free-hand drawing, 15; French, 10.

N. B. Examinations in subjects other than design will be held on April 11, 12, and 13.

TRADE SURVEYS

SOMETHING akin to a real-estate boom is in progress throughout the Southwest and West; it may, and quite probably will sweep eastward within twelve months, causing a general advance in the value of land, in manufacturing centres especially. This is a very broad, and perhaps a dangerous statement to make, but the indications are certainly very strong in favor of such a probability. It is only necessary to look at the progress of industrial enterprises in the South, especially Northern Alabama and certain sections of Tennessee and Georgia. The improvement set in in the coal and iron making districts of Alabama, and extended to surrounding localities; it moved northward, striking Nashville and Louisville, and has shown itself in a very pronounced way in Kansas and Missouri, and even in Nebraska and Iowa. Reliable authorities in several Western cities speak of the improvement as a "boom," and furnish interesting details as to the advance of land in certain localities where manufacturing and trade-requirements are of a very urgent character. It is unnecessary in a survey of this kind to endeavor to diagnose the causes and surrounding conditions of such an improvement — but simply to record the fact and note, in a general way, its present and probable future course. The abundance of money is one of the strong causes leading to this activity. The necessities for more extended travelling facilities, for larger supplies of iron and steel, and more house, factory, and mill accommodations are behind this force. The American people are moving on to a higher plane, where heavier requirements will be a permanent factor, and where a larger earning and consuming power will be maintained. Authorities in Minneapolis, St. Paul, Chicago, Detroit, and even in smaller cities, as Cleveland, Pittsburgh and Wheeling, speak with confidence of a *bona fide* improvement in real estate in and around those cities. Manufacturing enterprises are springing up among them and extending into the smaller towns. Real-estate operators are actively engaged in negotiations in the cities and towns, large and small, throughout the West. The East is sharing in the improvement, although it is more moderate, and of a more legitimate and enduring character. In Philadelphia a steady expansion in the values of property in and near the city is spoken of. In New York an improvement, apparently somewhat speculative in its character, is manifesting itself, but, after all, it is a legitimate advance. Along the Atlantic coast we discover evidences of activity and improvement, based upon legitimate causes.

The supply of building material will equal all requirements. A large amount of business remains untransacted, because of the uncertainty as to freight rates. During the past thirty days — in fact, ever since the new Inter-State Commerce Law was signed — the lumber-dealers have been crowding shipments East, West, and South, and secondary markets throughout the country are now pretty liberally supplied. The distribution of lumber from wholesale yards has increased within the past few days. The rush of lumber from Chicago to the East is spoken of as being "like a current of a mighty river cutting a deep channel through contiguous territory, leaving the space on either side high and dry." This movement has been caused by the low freight rates; it will terminate April 1. Eastern buyers have purchased very heavily of white pine, and are now engaged in placing contracts for lumber supplies from the South. Rolling-stock is taxed to its utmost capacity at all lumber centres, and the local demand in all towns is reported to be steadily increasing. In Minneapolis, 72 permits were issued last week; in St. Paul, 90; in Philadelphia, 140; in Pittsburgh, 60; in several other towns from which reports are received, the number ranges all the way from 20 to 100 for the week. These facts show that builders will be fully employed, and that building-material will be in active demand. The great industrial barometer, the iron trade, points to a general improvement in demand in April. During the past three weeks business has been checked by several causes, such as the heavy purchases made during the two first months of the year, the uncertainty during the past month as to freight rates in the future, and besides this, the high range of prices reached, warned customers not to place heavy contracts for future delivery, in view of the possibility of heavy foreign importations.

All the furnaces and mills are crowded with orders, and capacity, in nearly every direction, remains unsold. The steel rail-makers have approached within 300,000 tons of their gross capacity. There are inquirers on the market for very large lots of foreign rails, as well as other foreign material. Within the past week large orders have been placed for locomotives, and larger orders for cars. The structural mills are considering inquiries for supplies for bridge-building, and will, no doubt, have their capacity fully occupied throughout the East. Nails are quoted at $2.50, car-lots in the East, and $2.70 West. Bar-iron, $2.20 East, $2.10 West. Plate-iron, $2.40; steel-rails, $39 at mill; old rails, $23 at tidewater; steel-blooms, $32 to $35.

The demand for wood-working machinery continues steady, especially in the West, and some establishments have three months' contracts for their regular force. East of the mountains shops are not crowded with orders, but are doing a fair business. Sash, door, and blind factories East and West are full of business.

The supply of slate, stone of all kinds, and brick of all qualities, will be fully equal to current requirements, and there will be no delay in meeting demand this year, as there was last. The labor question has been disposed of, and manufacturers have been busy since last summer in arranging to meet the demand which they were wise enough to foresee.

The anthracite coal combination will mine 34,000,000 tons this year, of which the April out-put will be 2,250,000. The combination has been virtually renewed, but in such intangible shape as to be beyond the reach of legal technicalities. The bituminous coal pool has been formed, though no direct effort will be made to control the price of coal in markets, but only at distributing points along the Atlantic Coast. The bituminous coal production will be from 10 to 15 per cent heavier this year than last, while the anthracite will be little, if any heavier. Western coal producers will mine and ship about 10 per cent more than last year, and at prices ranging from 5 to 10 per cent higher. Fortunately for the country at large, the labor organizations have wisely decided upon pursuing a conservative and law-abiding course; the baser elements of organized labor have been placed under discipline, and the organizations, both of the Knights, and of the old Trades-unionists are bent upon making the best of the exceptional opportunities afforded for employment at good wages. Legislation is being earnestly sought for in several States, and the law-makers are showing a creditable desire to meet all reasonable requests upon the part of the wage-earners.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. No. 589.

APRIL 9, 1887.

Entered at the Post-Office at Boston as second-class matter.

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ACCORDING to the newspapers, Mr. Powderly has been saying some very curious things about certain shoe manufacturers of Massachusetts, who propose to remove their business from the large towns to the country districts, where they will be free from the interference of demagogues and labor reformers. According to the chief workman of America, who receives an enormous salary for guiding by his wisdom the conduct of millions of his poor fellow-citizens, it is useless for any manufacturer to try to hide in the wilderness from the might of the Knights of Labor. Wherever labor is employed, the "Colossal Organization" over which Mr. Powderly reigns will follow it and get up strikes for its benefit. For Mr. Powderly thinks that strikes necessarily benefit working people, whether they are successful or not. If unsuccessful, though they cause much suffering to the workmen and their families, they "leave a much deeper hole in the employer's pocket-book," and this Mr. Powderly considers a great gain. It must be a comfort to the persons immediately engaged in an unsuccessful strike to learn that they are in some mysterious way profited by the privations which they have undergone, but we do not find it very easy to understand how this is shown. The same newspaper in which we find the report of Mr. Powderly's remarks contains a story about a man in Chicago who was recently observed at an auction sale of goods left unclaimed at a police station. He seemed particularly interested in an old baby-carriage, and when it was knocked down to him he appeared so pleased that a reporter followed him to inquire into its history. It turned out that the poor man wanted it to remind him of the blessings which he had derived from a strike. Not long before, he had been ordered by the magnates of the association to which he belonged to strike, on account of some matter in which he had no personal interest. He did not wish to strike, being quite content with his own position and wages; but he did not venture to resist the mandate of the "Colossal Organization" which, as Mr. Powderly observes, "will not stand much nonsense," and he obeyed. The strike was a long one, and before it was over his wife and baby both fell ill from privation and anxiety. They were taken to a hospital, founded and maintained, as we may remind Mr. Powderly, by those employers of labor whose pockets he wishes to deplete, and there died, leaving the husband and father alone in the world. The strike continued, and more blessings came to him. He could not live on nothing, and he could not pay his bills, so the sheriff came and took everything that he had, including the carriage that his baby used to be taken out in. In remembrance of the mother and child the man kept track of the carriage, although it was but a poor affair. It passed through several hands and came at last to the police station, and after remaining there a certain length of time was advertised for sale. The strike had by this time been declared off, whether after the successful election of the head workman to some desirable office, or the escape of the head treasurer with the funds, we do not know; and the bereaved knight was free to find work again if he could. Fortunately, he succeeded, and at the time of the sale was ready with a little money to try to buy back the only memento that he could trace of his lost family. He was very much afraid that some one would offer more for it than he could give, but no other purchaser appeared, and the poor man, pushing his prize toward his solitary home, wept, as he told the sympathizing reporter the story of his former happiness, and of the benefits, perhaps a trifle disguised, which he had derived from his connection with the "Colossal Organization."

ANOTHER example of the beneficent working of the institution which Mr. Powderly thinks so much of is to be found in a case reported from Boston, recently. Soon after the strikes of last winter on the horse-railroads, some charitable person, who thought, erroneously, according to Mr. Powderly, that such affairs were misfortunes to those who were induced to take part in them, made a visit to the family of a conductor who lived in the neighborhood, to offer the assistance that one Christian owes to another. He found the house in the usual destitute condition of strikers' homes after a protracted effort to "make a hole in their employer's pocket-book;" but the conductor's wife showed a distress which even poverty could not account for, and he looked about to find the cause. A heavy snoring in the adjoining room gave him the clue, and looking in he discovered the husband stretched on the bed, helplessly drunk. It was the first time, as the poor woman said, that such a thing had ever happened, but her husband had been unable to find any other work, and deterred by the exhortations of the officials who were drawing four dollars a day for their services in keeping up the enthusiasm, as well, perhaps, as by the sight of a "scab" conductor hanging senseless over the dasher of his car, after a practical demonstration of the fact that the Knights of Labor "will not stand much nonsense," had waited quietly for the autocrats to dispose of his fate until patience gave way to despair, and he took to drink to drown his misery.

THE beginning of April usually ushers in the season of strikes in the building trades, and the agitators have begun their operations with as much confidence as if they had already forgotten the terrible lessons of last year. In Boston, the carpenters, to whom the associated master-builders offered a working day of nine hours, very sensibly acceded under protest, pending a conference between the masters and the representatives of the men. In Chicago an effort is to be made by the carpenters to secure a working day of eight hours, but they seem disposed to listen to reason, and the prospect is that there will be no serious trouble this year. In New York the walking-delegates have shown generalship enough to make the first attack, and, through the pusillanimity of some one, have won a signal victory, which they will probably turn to good account before the season is over. The pretext for the demonstration was the employment of some men in running wires in the new part of the Equitable Building who did not belong to the "Electric Wire-men's Union." Nine of the workmen were employed by the contractor for the building, but there were eight more who were furnished by the United States Illuminating Company, and were under the direct control of the Equitable Company. The walking-delegate of the Wire-men's Union heard that some men were employed on the building who did not belong to his society, and immediately proceeded thither to demand their discharge. Mr. King, the superintendent of the work, who knew well the power of the unions, and probably felt a responsibility toward the company for the thirteen hundred men under his charge, which made him more timid than he would have been if he had been acting for himself, answered the delegate with fair words, and said that he would do the best he could about it. He went, accordingly, to Mr. Pride, the general contractor, and, on his representations, Mr. Pride discharged all the non-Union men employed by him. Mr. King then went to the Directors of the Equitable Company, and told them what was demanded of them. Directors of insurance companies do not often have the heavy hand of the walking-delegate laid upon them, and the Equitable officials

indignantly refused to obey the mandate. When the wire-men's delegate came back to look after the matter, he was told of the contumacy of the directors, and proceeded to call a meeting of the walking-delegates of all the building trades. They resolved to prevent the completion of the Equitable Building until their orders should be obeyed to the letter, and the next day went to the building in a body, and called upon every man in it to pack up his tools and come out. Eight hundred and seventy-two men left their work at the signal; four hundred, by order of the delegates, remaining until the next day. On the following day, however, the directors of the insurance company, who began to realize the power of the tyrants of industry, and had no disposition to make martyrs of themselves for the sake of a few poor wire-stringers, gave in, turned the non-union men adrift, and were soon gratified by the renewal of the sounds of work in their building. What became of the non-union wire-men we are not informed, but it is easy to guess that they are at present engaged in packing their household goods, preparatory to leaving a city where they are not permitted to earn an honest living. If they could only get the people of New York to understand fully their condition, we are quite sure that they would find champions enough for their cause. We remember very well the attempt of a little faction of Irishmen, some years ago, to walk in procession through the streets of the city. The opposing factions of Irish, who outnumbered them more than a hundred to one, swore that the procession should not take place, or, if it did, that the men who walked in it should not return home alive. This threat aroused the attention of the public, and on the appointed day twenty thousand armed citizens enclosed the little Orange procession in their midst, and walked with it over the appointed route, in order, as they said, to show that any man in New York had the right to march peaceably through the streets wherever he wished, without being molested. The right of earning a living for one's self and one's family is quite as sacred as that of parading about to celebrate an unimportant fight in a foreign country; and when the New Yorkers realize that this is seriously threatened in their city, they will find some means of defending it.

IT seems that there is some danger that the system of supplying hot water under pressure for public use, which nearly obtained possession of the streets of New York a few years ago, may get a foothold in Boston, where some able and energetic men appear to be interested in the matter. As described in the daily papers, the Boston scheme is rather less objectionable than that proposed in New York, the proposed street-mains being smaller, and the temperature and pressure of the water considerably lower; but there is quite risk enough involved to make it desirable to watch the plan closely. The Boston company proposes to lay three-inch mains through certain streets in the business quarter of the city, to supply water at a temperature of four hundred degrees Fahrenheit, which will give it a pressure of two hundred and thirty-five pounds to the square inch. The water is to be used in the neighboring buildings for "heating, cooking and power," but no very definite details are given as to the methods of utilization. We can understand how power can be supplied to steam-engines, since a quart of water at such a temperature, as soon as drawn from the pipes, will instantaneously flash into about ten barrels of steam; but how pipes containing so fearful a force can be safely used in heating, still more in cooking, we are unable to understand. To state the matter very briefly, as we have before done in speaking of the New York scheme, the pipes will contain an explosive substance far more powerful, and more violent in its action, than gunpowder. It is quite possible, though in our opinion not very probable, that pipes, connections and expansion-joints can be made which will resist the ordinary pressure of the water; but there is reason to suppose that superheated water under pressure is liable under some circumstances to a sort of detonation, or sudden resolution into steam, the violence of which no ordinary materials can withstand. The effect of such a detonation in a street-main can be pretty accurately represented by the explosion of a line of twenty-five-pound kegs of gunpowder, placed eight feet apart beneath the pavement, and fired simultaneously. It is hardly necessary to say that there would probably be few persons left alive in the street after such an explosion, which would tear the roadway, if not the neighboring buildings, into fragments. Many years ago, as our technical books inform us, it was not unusual to warm houses in England by means of highly superheated water, circulating through enormously thick wrought-iron tubes of small diameter, and heated by a boiler in the building; but explosions took place so frequently that the system was abandoned, and heating by hot water under pressure is now only practised in modified and comparatively innocuous form. So far as we can see, the scheme now proposed for Boston is a revival, on an appalling scale, of a system condemned long ago, when tried on a far smaller and safer scale; and, although we should be sorry to stand in the way of improvements, or of legitimate business enterprises, the people who have to walk through Summer and Devonshire Streets have a right to demand that nothing shall be laid beneath their feet which exposes them to the risk of being blown into eternity if a sudden shock to the pipes, such as might be caused by the water-hammer produced by the closing of a valve, should determine a rupture.

IT seems that the magnificent Palace of Justice at Brussels, one of the most costly structures in Europe, has shown evidences of a settlement which may or may not prove to be serious. The *Weiner Bauindustrie-Zeitung* says, that early last fall, during the vacation of the courts, the ceiling of one of the court-rooms fell without warning, and another followed almost immediately afterwards. There had been evidences previously of injury to the lower portion of the building from the dampness of the ground, but no movement had been noticed. However, a third ceiling soon fell, and cracks began to show themselves in a number of others. The newspapers raised the alarm, and called for an immediate investigation, and the Minister of Justice appointed experts, who made a thorough examination of the building, and reported that no less than fifty-three ceilings were in danger of falling. They did not attempt to assign a cause for the cracking of the plastering, but contented themselves with taking measures for making the threatened ceiling secure, and repairing those that had fallen. There were, however, of course, plenty of amateur explanations of the trouble, most of which accounted for it on the theory that the layers of chalk on which the building rests had been so saturated by the springs which exist in them, that they had yielded under the weight of the building, and allowed it to slide down hill, as the Albany capitol is often supposed to be doing. There may be something in this, but it will probably take time to determine whether any action of the sort is really taking place. Meanwhile, there is no need of being in quite such a hurry as one of the Brussels editors, who suggested that, as the building was sure to fall, it might be well to take advantage of the opportunity to raise a little money to go toward the expense of rebuilding, to put on special trains on the Government railways to bring strangers to witness the catastrophe. The fall of the tower, particularly, would attract visitors from all parts of the continent, to say nothing of the English, who would come over in a body to witness the crash.

THE Philadelphia Insurance companies have undertaken to bring about an improvement in the fire risks of that city, by the introduction of a system of inspection, under which they make recommendations and suggestions to their policy-holders, concerning precautions which would lessen the danger of fire in the buildings which they insure. We do not see that they do anything to enforce their suggestions by concessions in rates to those who comply with them; but the public seems to be pleased with the novelty, and one serious fire, at least, has already been prevented by following them. Most of the recommendations relate simply to such precautions as the avoidance of wooden barrels for receiving hot ashes, or the introduction of steam-pumps in places where the pressure of water in the street-mains is feeble; but the larger manufacturers have been advised to protect their goods with automatic sprinklers, and a reduction in premium rates is made to those who do so. All this is very good as far as it goes, but it will be necessary to follow up the work with a good deal more persistency than insurance companies generally show, in order to accomplish any lasting reform. So long as the novelty lasts, some of the policy-holders will be willing to try experiments in guarding their property against fire; but they will soon come back to the old notion, that this is what they pay the underwriters to do for them, and unless they can be shown some inducement, in the shape of lower rates, for troubling themselves about the matter, they will make the reflection, which is perhaps not wholly groundless, that the insurance companies are trying to use them as cat's-paws, to save money for themselves.

MONUMENTAL STATUARY IN THE CITY OF MEXICO.

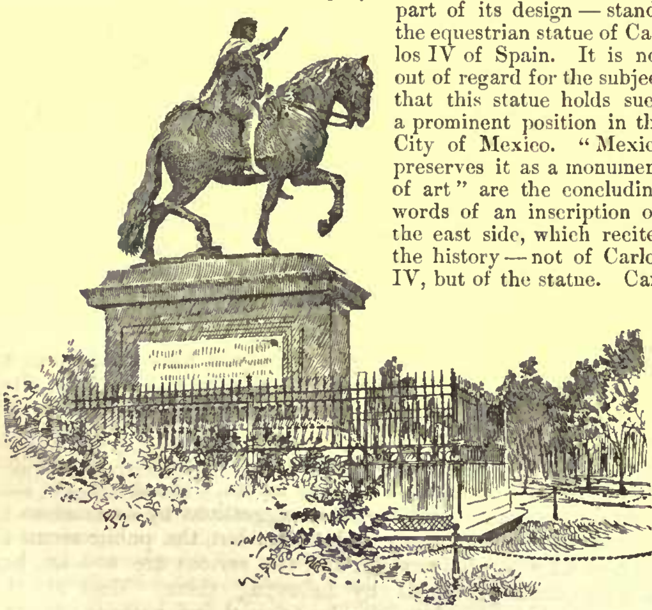


Bust of Cuauhtemoc.

TO the visitor at the Exhibition in New Orleans in 1885 the music and painting of Mexico were an unexpected revelation. That the sister Republic possessed any musical talent, or that the Mexicans produced any paintings of merit had never before been suspected. It remains for the visitor to that interesting country to learn that the art of sculpture is not neglected there, but receives considerable popular encouragement. The monumental statuary of the Capital attests the progress of the sculptor's art in the country, and the extent to which it is fostered by the popular taste. Nearly every city of any size in the Republic possesses at least one meritorious public statue, while the Capital contains so many that it might almost be called a "City of Statues." Let us view it with reference to that feature.

The Paseo de la Refoma, the fashionable drive of the city, is a broad avenue leading out to the gates of the Castle of Chapultepec, a distance of two miles. If not already, it is destined to be one of the most beautiful drives of any city in the world. It is in itself a monument to the energy and taste of the Emperor Maximilian, for it was by him planned and begun. Six "*glorietas*," as they are called, or circles similar to those in the avenues of Washington, are laid out at regular intervals in the course of the Paseo, the design being to place in each an historical statue or group. In the first a statue commemorative of the discovery and settlement of the country has been erected, and will be hereafter more particularly described. In the second, a monument to Cuauhtemoc (Guatemotzin) has been begun. It is the intention to place a statue of Benito Juarez in the third. Subjects for the other three have not yet been selected.

At the head of the Paseo — having occupied that spot more than ten years before the Paseo was projected and being, therefore, no part of its design — stands the equestrian statue of Carlos IV of Spain. It is not out of regard for the subject that this statue holds such a prominent position in the City of Mexico. "Mexico preserves it as a monument of art" are the concluding words of an inscription on the east side, which recites the history — not of Carlos IV, but of the statue. Carlos IV was among the last sovereigns of Spain before the independence of Mexico. It was his encroachments upon the rights of the Mexicans which led to the revolt of that country. It was at some pains, therefore, that the statue was preserved from destruction at the hands of the people in their hatred of the tyrannical subject and the despotic government which he represented.



Carlos IV.

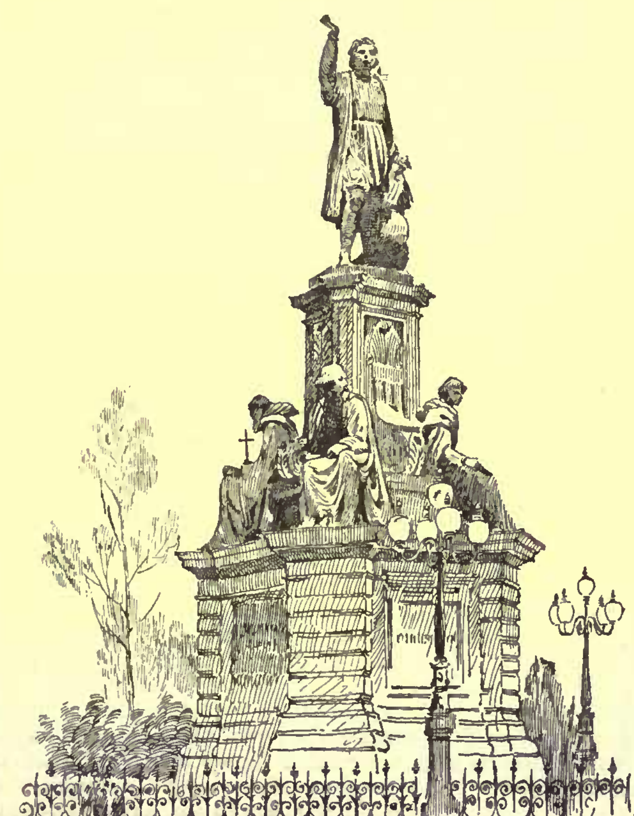
The statue was the acknowledged masterpiece, in sculpture, of Manuel Tolsa, sculptor and architect, who came from Spain in 1791 to be professor of sculpture in the San Carlos Academy. That institution was then in its youth and struggling for its existence. Many of the churches of the Capital and the vicinity attest the genius of Tolsa as an architect and a designer. There are several traditions regarding Tolsa founded upon his sudden death soon after the completion of the statue. One is that he committed suicide on overhearing some rustics criticise his work — noting, among other things, that the king was riding without stirrups. Another is that he was so affected by the grandeur of the work that he dropped dead while contemplating it soon after it had been unveiled.

Humboldt's comment on the Carlos IV statue was: "This work excels in beauty and purity of style any equestrian statue in Europe, excepting only that of Marcus Aurelius in Rome." It is especially notable as being a solid bronze casting and the first bronze statue of any importance cast in the Western world. The work was accomplished in the City of Mexico in 1802. The thirty tons of metal required for the work were two days in melting, and when the immense vessel holding the metal was tapped the liquid bronze flowed freely, filling the mould in fifteen minutes. It was allowed to cool for several days. It was then removed from the mould and found to be complete and without defect. Among numerous traditions regarding the work is one to the effect that the quantity of metal required for the casting was so closely calculated that only a "bucketful" was left over after the casting was completed. If this be so the success of the work should have made the fame of Salvador de la Vega, under whose superintendence it was accomplished. It cannot be discovered that it has done so.

Several months were spent in perfecting the statue after it came from the mould, and it was in the latter part of 1803 that it was placed upon its pedestal in the main *plaza*, directly in front of the great cathedral. It passed safely through the series of revolutions from 1810 to 1821, which ended in the independence of Mexico, but after that the feeling against Spain and everything Spanish was so bitter that it became necessary to protect it from the hands of the people. An immense wooden globe was built over it and painted blue. This afforded sufficient protection for a time, but in 1824, for greater safety, the statue was removed from its pedestal to the *patio* of what was then the University Building. There it escaped public attention until 1852, when it was deemed safe to set it up where it now stands.

The horse and rider are seventeen feet in height. The king is dressed in Roman costume, wearing a wreath of laurels and holding his sceptre in his right hand. The horse is represented as walking slowly.

The monumental commemoration of the discovery and settlement of the country is popularly known as the "Colon Statue" from the heroic statue of Cristóbal Colon (Christopher Columbus) which surmounts it. It is the work of a French sculptor, Cordier, resident in Mexico, and was the gift to the city of a wealthy citizen. It consists of a base of red marble, containing bronze panels, upon which are represented in bas-relief the arms of Columbus surrounded by a wreath of laurel; a fragment of a letter written by him; the dedication of the monument; and two scenes from the life of the discoverer, viz., the rebuilding of the Monastery of Santa Maria de la Rabida, and the landing on San Salvador. Upon this base are placed four life-sized figures, in bronze, in a sitting posture. They



The Colon Statue.

are of Fathers Marchena and Debesa, of Spain, the two priests to whom Columbus was finally indebted for the long-delayed royal favor, and Father Pedro Gante and Bishop Bartolemeo de las Casas, the two famous missionaries to Mexico, whose lives were devoted to the cause of the Indians. From the midst of these bronze figures rises the red-marble pedestal of the statue of the discoverer. He is represented in the act of removing, with his left hand, the veil which hides the Western Hemisphere, while his right hand is held aloft. The whole work is admirable alike in conception and treatment.

Work has been suspended upon the Cuauhtemoc (Guatemotzin) monument for several years, but enough has been accomplished to exhibit in the base and pedestal a very skilful combination of classical and early Mexican styles of ornamentation. It is the work of the Mexican architect and sculptor, Francisco Jimenez. A bust of Cuauhtemoc, the last Aztec Emperor, and the hero of Gen. Lew Wallace's charming story "*The Fair God*," was erected on San Hipolito's day, 1869 (August 13, the anniversary of the final conquest of the city by Cortez in 1521), on the banks of the Viga Canal, some distance from the city. The bust stands upon a high pedestal, upon which is an inscription, on one side in Spanish, on the other in the Aztec language, reciting the heroic defence of the city by the Aztecs under the brave young emperor. It attests the Aztec sympathies of the Mexicans and their high regard for Cuauhtemoc.

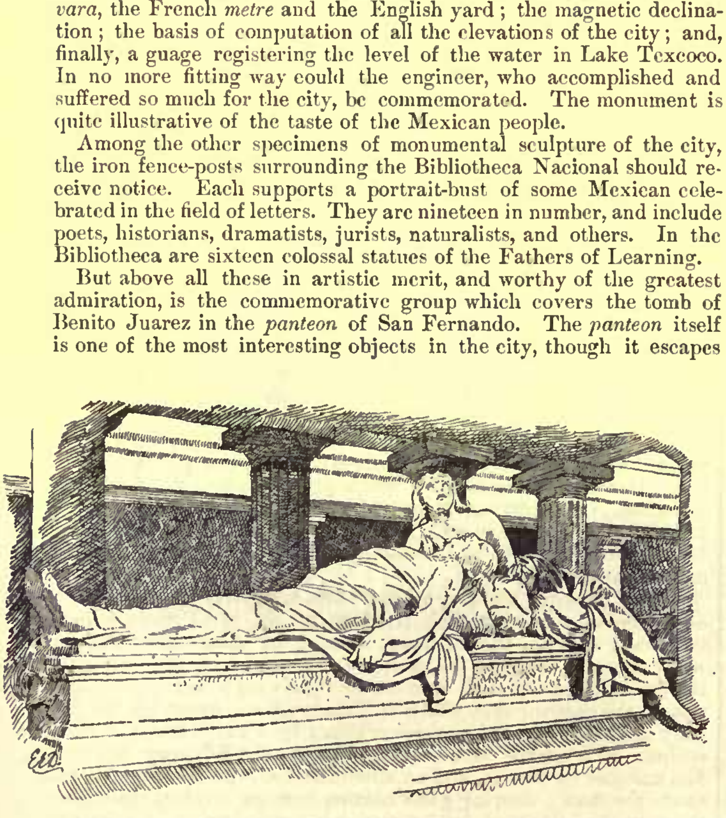
Of three other statues which adorn the streets of Mexico, one is the marble statue of the patriot-priest and revolutionary hero, José Maria Morelos, standing in a little garden between two churches opposite the Alameda. It is the work of the sculptor Piati, and has little merit as a work of art. It is interesting, historically, as having been unveiled in 1865 by the Emperor Maximilian on the centennial of the birth of Morelos.

The sculptor Noreña has two fine bronze statues on the line of the same street. One is that of the famous revolutionary leader, and second president of the Republic, Vicente Guerrero, standing in the garden in front of the church of San Fernando. The tomb of Guerreo is in the *panteon* attached to the church.

The other statue by Noreña is deserving of closer attention. It is an heroic female figure representing the gratitude of the City of Mexico to Enrico Martinez, the engineer who designed and constructed a tunnel four miles in length, for the purpose of draining the lakes of the Valley of Mexico and preventing the inundation of the city. Martinez suffered many changes of fortune during his life in Mexico, among them four years of imprisonment because his work was not immediately successful. The work now exists as the open cut, or *tajo de Nochistongo.* When it was deemed proper that the labors of Martinez for the City of Mexico should be commemorated, no portrait of him was to be found. The sculptor, therefore, devised a very original monument. The pedestal is filled with items of engineering data, such as the standards of measurement, the Mexican *vara*, the French *metre* and the English yard; the magnetic declination; the basis of computation of all the elevations of the city; and, finally, a guage registering the level of the water in Lake Texcoco. In no more fitting way could the engineer, who accomplished and suffered so much for the city, be commemorated. The monument is quite illustrative of the taste of the Mexican people.

Among the other specimens of monumental sculpture of the city, the iron fence-posts surrounding the Bibliotheca Nacional should receive notice. Each supports a portrait-bust of some Mexican celebrated in the field of letters. They are nineteen in number, and include poets, historians, dramatists, jurists, naturalists, and others. In the Bibliotheca are sixteen colossal statues of the Fathers of Learning.

But above all these in artistic merit, and worthy of the greatest admiration, is the commemorative group which covers the tomb of Benito Juarez in the *panteon* of San Fernando. The *panteon* itself is one of the most interesting objects in the city, though it escapes



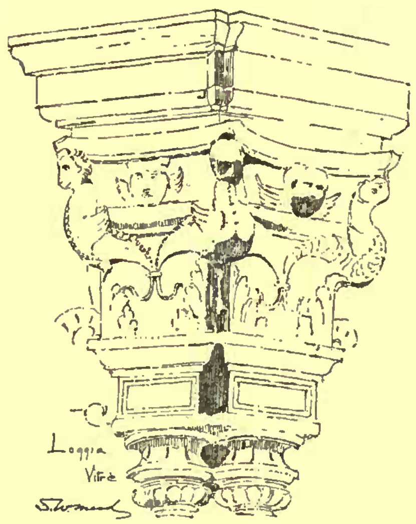
Tomb of Benito Juarez.

the attention of most sight-seers. It contains the tombs of many of the most illustrious personages of later Mexican history. Ex-presidents Guerrero and Comonfort, General Zaragoza and the Republican patriot O'Campo are buried there. There are also the tombs of Generals Mejia and Miramon, the companions of Maximilian in his final struggle for the Empire—his companions also in his execution. Nearly midway between these two tombs is that of Benito Juarez, the Indian President of the Republic, who maintained his government throughout all the stormy period of 1864–1867, and who was deaf to all the entreaties on behalf of Maximilian and his two brave generals.

The group represents the president stretched at full length upon his death bed, his head resting upon a pillow. Sitting at his head is a beautiful female figure, emblematic of Mexico mourning the loss of her favorite hero. The grief of a nation could not be more beautifully expressed in white marble. The work is impressive in the highest degree. As a work of art it is original, free from conventionalisms, and technically excellent. There is probably no work of the kind on the continent approaching it in beauty. It is the work of two brothers, Islas by name, of Indian extraction. It attests their own artistic genius, and is the pride of the race from which they sprang. It reflects credit also upon the artistic taste of the country to which those artists belong.

ARTHUR HOWARD NOLL.

THE PHILADELPHIA EXHIBITION OF ARCHITECTURAL DRAWINGS.



IN connection with its fifty-seventh annual exhibition, the Pennsylvania Academy of the Fine Arts has for the first time opened its doors to the architects.

The result is a collection of architectural sketches and studies that, although comprising but seventy-seven frames, possesses a good deal of interest. Whether or no the hanging-committee has been wise in its evident effort to keep drawings of a certain coloring together, so as to produce a broad effect of tone on the walls, utterly regardless of any "setting-off" that a sketch may have from being put next one of entirely different character, is somewhat a matter of dispute, but certain it is that the impression on entering the room is a pleasing one.

The place of honor is rightly given to Mr. Clarence Luce's competitive drawings for the Eighth Regiment Armory, and for the Toronto Court-House. To the first of these, when shown at the last exhibition of the New York Architectural League, it was objected that the tower was too massive; but one is led to overlook this, in his admiration not only of the simplicity and originality of the design, but of the marvellous skill of the artist in his water-color work. The blending of grays and browns and warm yellows, the bright softness and exquisite cleanness of the washes, and the appearance of solidity of the mass of the building, unrelieved, except in the doorway, by a single shadow, are above praise. Mr. Luce's drawings for the Toronto Court-House, published in the *American Architect* some time ago, are too well known to need description. They are, of course, exquisitely rendered, and vaguely suggest something that Mr. Richardson might have done had he worked in Gothic. Mr. Luce sends as well his competitive design for a cemetery entrance, some capital water-color studies of country houses, and a much less happy rendering, in pen-and-ink, of a design for a hotel at Lake Chatauqua.

Following next on the left we come to seventeen sketches in various styles, but all of a more or less improbable character, selected from designs by the T-Square Club, of Philadelphia, an organization composed mainly of the younger architects and draughtsmen, for the purpose of competitive sketching. Among the most imaginative of these are three pen-and-ink designs by Mr. Wilson Eyre, Jr., one of which—a dormer-window cropping out between two tall chimneys—is particularly attractive.

Another of Mr. Eyre's sketches—a tall bridge and house—is picturesque in the extreme, but less constructional than one by Mr. Arthur Truscott, whose bridge, although one feels sure that it would not give way before any possible flood, rather conveys the idea that the architect's share in the design had been overbalanced by the engineer's. And is it not a pity, by the way, that there should not be a little more architecture in the bridges that are being put up in this country year after year? The engineer needs no architectural knowledge, it is true, in order to make a stone bridge a beautiful object. The arches are sure to have a beauty of their own. But the problem of making a beautiful bridge with stone piers and an iron framework has had very little serious attention from any but the French architects. And we all know the result, in our own country, of letting the engineers do all the designing of the thousands of excellent but hideous iron bridges that blot our landscapes.

After this observation it may be as well to state that Mr. Truscott's bridge, as sketched, is of wood, and although evidently built for use, is certainly not ugly. Another drawing by the same hand is a

design for a city house — a few light sepia washes on brown paper, over some sweeping but accurate pencil lines, not one of which is unnecessary, make an admirable example of a style of rendering that many of our draughtsmen would do well to take as a model.

An excellent drawing in the "T-Square" series is a design by Mr. Lindley Johnson for a hall fireplace. It is an elevation in pale washes and brown ink, and has the fault, very common to such drawings, of having been worked over a little too much with the pen. A sketch of Mr. Louis C. Hickman's, in sepia and Chinese white on gray paper, shows how a great deal of effect may be obtained with but little labor, and a "T-square" drawing by Mr. John J. Dull, of an enormous pulpit approached from the front by gigantic steps, and from the back by microscopic doors, demonstrates how the charm of a skilful water-color can make one forgive the most obvious faults of perspective. Near this last hangs a large frame by Mr. Benjamin Linfoot, containing some good coarse line sketches, but much marred by a bird's-eye view of several very red cottages, on a lawn of startling green. Messrs. Hazelhurst & Huckel have four very carefully worked-out perspectives, notably a highly-colored one, of the Court-House at Woodbury, in which the design — in the American-Romanesque style that as yet shows no signs of dying out — is infinitely better than the rendering.

In Number 596 we have four country houses by Messrs. Chamberlin & Whidden. Clever and effective these drawings are — light, clear washes on dark paper relieved by Chinese white. It is to be regretted that in their sketch for a Colonial house at Cambridge — (Number 595) a thoroughly good and consistent design — this dangerous material should have been laid on so lavishly.

Mr. T. P. Chandler, Jr., only contributes four sketches, but they are all in his best manner. One in particular—an idea for a chimneypiece, done on gray paper with very light sepia washes and the merest suspicion of Chinese white — is altogether charming. Mr. F. H. Bacon shows the two admirable sets of drawings — his sketches from Athens and furniture sketches — that were exhibited in New York during the winter. Apropos of these, why do men whose drawings are otherwise faultless mar their effect by introducing figures done with a carelessness that is little short of criminal? Surely Mr. Bacon cannot imagine that his phenomenal sheet of details from Athens is any the better for the stuffed figure that accompanies it, or Mr. Luce consider his hotel drawing improved by the bodiless horsemen in the foreground.

Mr. Walter Cope's three frames of pencil sketches in France and Italy are more than architect's notes; they are some of them pictures, and are all either picturesque or useful. Their usefulness might, however, have been increased by a few measurements, and the captious might add that their value as pictures would not have been injured by a little less black-lead. The opposite fault is characteristic of the half-dozen sketches sent by Mr. F. M. Day, whose drawings of French, German and Italian details bear the stamp of accuracy, but have a certain baldness, in contrast to Mr. Cope's.

Mr. Wilson Eyre has seven of his admirable country houses, mostly in light washes and a little pen-work, besides two sketches of city buildings that are nearly as full of feeling. A greater contrast to these free, almost fanciful designs cannot be found than in the section of a grand staircase that Mr. Lindley Johnson exhibits. This drawing, accurate, elaborate and formal, its colors subdued by skilfully graded washes of India ink, is a *projêt* that years ago gave Mr. Johnson one of his *mentions* at the École des Beaux-Arts, in Paris. Messrs. Cope & Stewardson have some neatly-drawn studies for country houses, and a competitive design for the Savannah Cotton Exchange, that bears a strong likeness, especially in its upper story and tower, to the Palazzo Vecchio.

Number 667, an altar, by Mr. Arthur Truscott, is well worthy of notice. The drawing is admirable and the design full of the spirit of Gothic architecture.

Above the drawings hang some plaster casts and studies for architectural sculpture. One is a half-size study for the spandrel of a doorway designed by Mr. Eyre, and another a vestibule frieze, some four feet high, by the same architect.

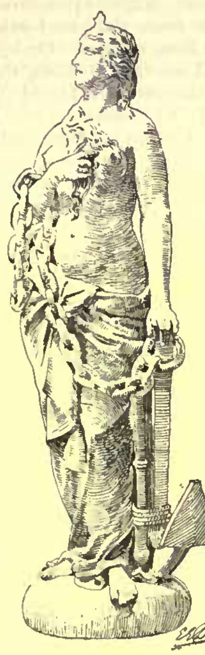
Mr. Jesse Godley, the animal sculptor, has some fragments of a frieze for the Radnor-Hunt Club. The figures, hounds and a field of huntsmen, are in very flat relief, with strong outlines, and sunk below the surface of the plaster, somewhat after the Egyptian manner. The action in some of the horses plainly has its authority in instantaneous photography, but does not seem out of place in a composition so sketchy and delightful as this. It must be acknowledged, however, that the best sculpture in the room does not properly belong there, as it is not architectural. It consists of five small pieces by Mastrodonato; four of them girls' heads in bronze, and the fifth a fascinating little figure in pear-wood, about eighteen inches high, catalogued as "Very cold."

In fine, the Philadelphia exhibition, although many of the best things in it are not new, having been reproduced in the *American Architect*, or shown at the Salmagundi Club, is an innovation on the staid course of the Academy, and apparently a successful one.

C. H.

SNOW DRIFTS. — Here is a scientific nut which John Ross ruthlessly hurls in the teeth of natural phenomena delineators: "Why is it that along railroads and the highways the snow always drifts from the high places into the depressions, while in lumber yards it drifts out of the depressions and accumulates up on top of lumber piles?" — *Plainview (Minn.) News.*

A REPUBLICAN MUSEUM.



IT is curious how few people ever visit the Hôtel Carnavalet, in Paris. Situated in the Rue de Sévigné, it is rather out of the way of visitors; but yet a pilgrimage due east cannot be better spent than in wandering about the museum, which the hôtel is now converted into. Near it, too, is the Palais des Archives, or Public Record Office, a most interesting museum of autograph documents, from the sixth century downwards, where one can read the marriage contract of François II and Marie Stuart, a letter, if I remember rightly, of the cruel guardian of poor little Louis XVI, and a blank warrant for guillotining thirty-seven persons whose names were filled in afterwards *ad libitum.* In one of the rooms is the table on which Robespierre lay after he shot himself. Not far off is the Gothic gate with its *tourelles* of the École des Chartres; and a little farther along the street is the Place des Vosges, formerly the Place Royal. It is still almost intact with its old red-brick houses, and its colonnades round the gravelled square, in the centre of which is a statue of Louis XIII erected under Charles X. During the reign of the former, it was of course the height of fashion, and the surrounding neighborhood swarmed with hôtels belonging to the gentlefolk. Now it is rather a desert waste, given up to noisy children. But the houses are worth studying, and if possible visiting. Richelieu lived in one, and in another Victor Hugo passed some of his days; this latter having belonged to a woman he has immortalized, Marion Delorme. Hard by, at the junction of the Rue Vielle du Temple, and the Rue des Francs-Bourgeois, is the Hôtel Barbette, with its beautiful little *tourelle*, a charming corner of old Paris. It has lately been restored — and very well restored. Another "monument" in the vicinity, which is not strictly architectural or archæological, but which is somewhat historic, is the Mont de Piété, the great pawnbroking establishment of Paris. It is really worth a visit; all the arrangements being unique; and to any student of physiognomies and morals, it is a wondrous study to scan the countenances, the dress, and the general manner and gait of the dozens of men and women who calmly wait their turn, seated on rows of benches in the great hall.

Carnevalat is a corruption of Kernevenoy, the name of an old Breton family who formerly owned the hôtel. It was built in 1550, by Pierre Lescot, and decorated with sculptures by Jean Goujon. It consisted then of the main building at the end of the court, and the ground-floor of the three other sides, and was inhabited by Jacques des Ligneris, President of the Parliament. In 1660, Mansard added the first floor to the sides, and the façade towards the street, in which he only retained the sixteenth-century doorway. In fact the only part of the building which remains of the Renaissance period is that at the end of the court-yard, and the ground-floor. Mme. de Sévigné lived in the hôtel nearly twenty years, from 1677 until her death in 1696, which took place at the Château de Grignan. Her apartment which she occupied with her daughter, Mme. de Grignan, was the portion now used as the library of the city. The grand staircase still remains, and the beautiful panelled decoration of the rooms, painted a soft, tender gray. M. de Grignan passed little of his time in Paris, but when there occupied the ground-floor underneath his wife and mother-in-law. M. le Marquis de Sévigné *fils*, lived in the apartment facing the street; and the Abbé de Coulanges, the uncle of Mme. la Marquise, the right wing. The left wing contained rooms common to the quintette. These now hold the engravings, and retain their old decoration.

After Mme. de Sévigné's death the hôtel was given over to the vulgar, mostly financiers, the farmer-general Brunet de Rancy being one. During the Revolution it was a printing-office, and afterwards the school of engineering, under the director Baron de Prony. Since 1830 it has successively been occupied by two boys' schools; but in 1866 it was purchased by the city, to be converted into an historical museum and library.

On the principal building are some fine sculptures by Jean Goujon — the Seasons: spring, with the sign of the ram; summer, with the crab; autumn, the balances; winter, the goat. The masques, which serve as bosses to the vault of the ground floor, are by Ponzio; the bas-relief on the small door on the right wing is modern, in imitation of the opposite one, which is Renaissance. Above, on the first story are some very inferior restorations by Van Obstal, a Flemish sculptor, who worked under Mansard. On the left wing are some fine masques by Ponzio, and an admirable bas-relief by Jean Goujon above the door: sleeping genii holding burning torches, symbolic of the eternal vigilance of justice, even when she sleepeth. On the first story are some bas-reliefs of the date 1660, the Four Elements, surmounted by their attributes. On the side of the entrance are bas-reliefs by Jean Goujon, in his very best style: Authority, a little figure, standing upon a globe, between two figures of Fame, bearing palms and laurels. Two vanquished lions, placed originally over the small side doors, and removed by Mansard to the street façade, completed

the design which was symbolic of morality overcoming brute force; a fit subject for a house built for the president of the Parliament.

On the street side, the doorway by Jean Goujon, happily preserved by Mansard; and the aforesaid lions detached from the court-yard façade are all that remain of the period of the Renaissance. On the first story are some second-rate bas-reliefs by Van Obstal, 1661, the period of Mansard's transformation of the elegant old Henri II house of the Ligneris, into the sumptuous Louis XIV hotel.

The object of the museum is to collect all books and other things which relate to the history of the City of Paris. Engravings, plans, manuscripts, and pictures form part of the library collection; while medals, pottery, and fragments of old buildings are placed in the lower rooms. The objects comprise all periods from the Gallo-Roman to the Renaissance. The collection of odds and ends relating to the revolutionary period of 1789–1804 was given by M. de Liesville.

In the Galerie des Arènes may be seen fossils and monuments of the stone age found in Paris and the neighborhood. Also some stones of the Gallo-Roman period which are supposed to have formed the ancient boundary of the City of Lutèce; these are coarsely engraved with names and symbols. Some of the Merovingian sarcophagi found in the cemeteries of St. Germain des Près and St. Marcel, and upon Montmartre, are very interesting, from the Christian symbols carved upon, resembling those on the walls of the Catacombs at Rome; and a Pagan one, with a sort of hatchet (*ascia*) is considered very rare in the Parisian region. Here, too, are a few fragments of the basilica church, which is supposed to have preceded Notre Dame. It may be worth mentioning here that a foolish practice has sprung up in France of calling cathedrals basilicas, for sake of impressiveness. Notre Dame and St. Denis are often spoken of as basilicas, which, of course, they cannot be. The basilica, as every one knows, is a church built upon the plan of the Roman Halls of Justice, and utterly at variance with the plan of a Gothic church.

Descending to the ancient sixteenth-century kitchen, the visitor finds himself at the foot of the stone staircase in a species of crypt, or funeral vault. Here are sarcophagi of the fourth and the tenth century, amongst which is a little coffin of a still-born child. In a niche illumined by a colored lamp are some casts taken from skeletons found in the first excavations of the Arena on the left bank of the river. This crypt is only open in the summer months, beginning in April.

Mounting the staircase we come to the Revolutionary museum — as strange a collection as may be seen anywhere. Some panels, coarsely painted, emblematic of the constitution of 1791: Glorification of Louis XVI, father of the French, and King of a free People; with diverse allegorical emblems, a Greek cross surrounded by circles and much red paint. A few pictures are interesting from their subjects; so are the charts containing the list of persons taking oaths to the constitution, and the chart of the Rights of Man, are all worth studying. One cannot help admiring both the sentiments and the enthusiasm of the early revolutionary period; and perhaps, when one passes into the next room and sees a *lettre de cachet* and various torture machines from the Bastille, one is not surprised at the brutality of the Reign of Terror so much as at the patience of the people who endured the grossest tyranny for so long a period. If your readers never saw a *lettre de cachet*, here it is; and note that they were kept ready, signed and given by the kings and their favorites, to be filled up with the names of any one towards whom the said favorite had a grudge: the king "prays the governor to receive ——— into our Château of the Bastille, and ends with a prayer that the unhappy prisoner may soon leave it." Let us return to the subjects of some of the quaint pictures. "Fête of the Sans-Culottes upon the ruins of the Bastille," 1793, a drawing by Pourcelly. "The Declaration of the Rights of Man." Portraits of the King and Queen, of Kleber, of Robespierre at the age of twenty-four, painted by Boilly in 1783; of Danton, Marat, Desmoulins, St. Just, and a host of others of the same period; the funeral of Marat at the Church of the Cordeliers, 1793; Fêtes held at the Bastille, Pont Neuf and Champs Elysées; Destruction of the Bastille. Amongst miscellaneous things are hinges and fragments of the door of the Conciergerie cells where Mme. Roland and Robespierre were imprisoned; a gun of the National Guard (1830) surmounted by an umbrella to protect "the Sons of the Fatherland, and Defenders of our Liberties" from sun and rain! a model of the Bastille, carved in one of the stones of the fortress; Republican almanacs with the new arrangement of seasons, months and days; wall-papers for official residences with revolutionary emblems; Phrygian caps and Jacobin caps; a young girl's sash worn at the ceremony of Voltaire's funeral, 1731; Talma's theatrical antique sword; David's last palette. Even watches and clocks were decorated to suit the feeling of the time; they had (the clocks) three faces showing the new decimal division of time into ten months, ten days, ten hours to the day, one hundred minutes to the hour, and one hundred seconds to the minutes. Fans and snuff-boxes, of course, partook of the same craze of decoration. Another curious relic is a sort of chart which was hung up in the schools: "*The French people recognize the existence of the Supreme Being.*" Can anything more fully show the egotism and *chauvinisme* of the nation? One patriot's snuff-box is in ivory in the form of a Phrygian cap. Then there is a complete collection of buttons, embroideries for waistcoats, scarfs, cockades, guns, sticks; the sword, left by Garibaldi to the town, which belonged to La Tour d'Auvergne, and the one given by the Directory to Massena in the year V.

Of the Second and Third Republics there are some very interesting water-color representations of fêtes; the "Allies entering Paris 1814," by Zippel; four of different events in 1814, by Vergnaux; others by Lacomte; these are all in the style of the day, careful in regard to details of dress and surroundings, and so are worth study by all who love the old Paris.

In the long galleries is a fine collection of porcelain and faïence. In the central case are some of the odd "balloon" pieces of Sèvres of 1783 and onwards. The balloon was a new invention, and consequently, the painters of china made it the subject of cups and vases. The balloon mounts, while a crowd gaze at it with upturned faces; or it is seen descending, and then the anxious crowd throw up their arms and receive it. It was evidently the *actualité de l'heure*. Another curious piece is the celebrated guillotine cup in Berlin porcelain, an anti-revolutionary effort. The mottos on the common faïence plates are droll, considering results: "*Ca ira; vives libres ou mourir.*" "*La Liberté sans licence.*" Hardly acted up to! At the entrance to the second gallery is a little colored wax model of Voltaire in his study, towards 1775, holding in one hand a cup of coffee, and in the other a pen; his inkstand being at his side. Here, too, is the chair the great satirist expired in, with two desks, for writing and reading, brought from the Hôtel de la Villette, where he died in 1878; also, the chair the poet Béranger died in. Many are the portrait-busts. It is well known that, after Marat's assassination, his sorrowing friends placed his bust in all the official rooms of Paris — hence innumerable ones of him are to be seen in all museums. Here is an odd device for clock ornamentation: *la jolie Révolutionnaire;* a soldier and a civilian support the pedestal which hold the clock; above is another pedestal supported by two monkeys in caps of liberty; on the top, a drunken-looking woman with a bag of money; below, on the ground, a mitre, a Papal crown, cross-swords, croziers, etc. All colored in the vulgarest style — the whole, evidently, very anti-Republican. Some of the Sèvres porcelain is in *pâte tendre*.

The picture-gallery is the dining-room of the Hôtel de Dangeau, Place Royale, removed here when the house was demolished. The ceiling is an early work of Lebrun's. Unfortunately, the light is so bad that it is difficult to see the interesting collection of pictures of old Paris which hang on the walls. They are: a thirteenth-century miniature of the "Miracle of St. Eloi"; some old scraps of boulevards and streets by Bouchot and Martial; the Cries of Paris in Eighteenth Century; a masked ball, held at the Hôtel de Ville, in honor of the marriage of the Dauphin, 1745, by Cochin; two charming little sketches, by Prud'hon — the portrait of Talleyrand, and a sketch for the marriage fêtes of Napoleon; a sketch by Largillière, and two by Benouville; Mme. de Longueville presenting her son to the members of the Fronde, 1649; Baptism of the Dauphin, 1668; the Fowl-market, in 1660, and the Fish-market and Laundresse's Boat at the Mégisserie, 1670; an old view of the pont Notre Dame during the aquatic sports of 1760; a number of different views of old Paris, most minute in detail, by Reguenet; and the fire-works on the Place de Grève, in celebration of the birth of the poor little Dauphin, 1782, by Moreau.

On the staircase are some fine examples of old wrought-iron, and various fragments of escutcheons and carved wood from old houses which have been demolished; and in the garden are a great many architectural fragments of old Paris Gothic and Renaissance, dug up during excavations for modern improvements. S. BEALE.

ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

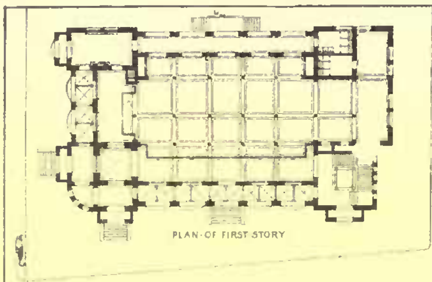
HOTEL DE VILLE, AUDENARDE, BELGIUM.

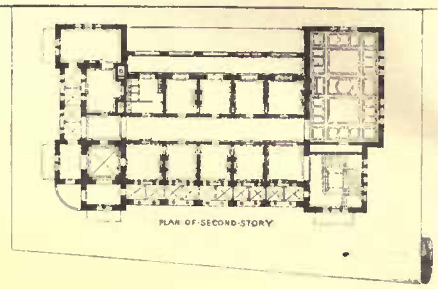
[Gelatine Print, issued only with the Imperial Edition.]

IT is to be noted that this view is reversed.

PLAN OF THE BANK OF MONTREAL, MONTREAL, CANADA.

THE Bank of Montreal, the head office of which is in Montreal, Canada, is one of the largest banking institutions of the world. It was first incorporated in the year 1818, with a capital of $250,000. The building originally held by the company, and occupying the site of the present post-office was destroyed by fire, three years after the act of incorporation. Their next office erected on the same site at a cost of £11,000, was a plain, substantial building of three stories' height, having seven windows along the front on each floor, and four along the sides. A small portico, the height of one floor only, of the Doric order, marked the principal entrance; the only other attempts made at external embellishment being four panels carved in bas-relief, over the ground-floor windows, emblematic of Agriculture, Manufacture, Art and Commerce. The bank frequently made application for the renewal of its charter, increasing its capital each time, until in 1871, the Banking Act was passed under which it has continued to exist and flourish. Its capital at present amounts to $12,000,000. The present building erected in 1847, occupies the site adjoining the former office. It is of the Corinthian order, and has in the principal façade a large portico of six massive fluted columns, which rise to the height of the ceiling of



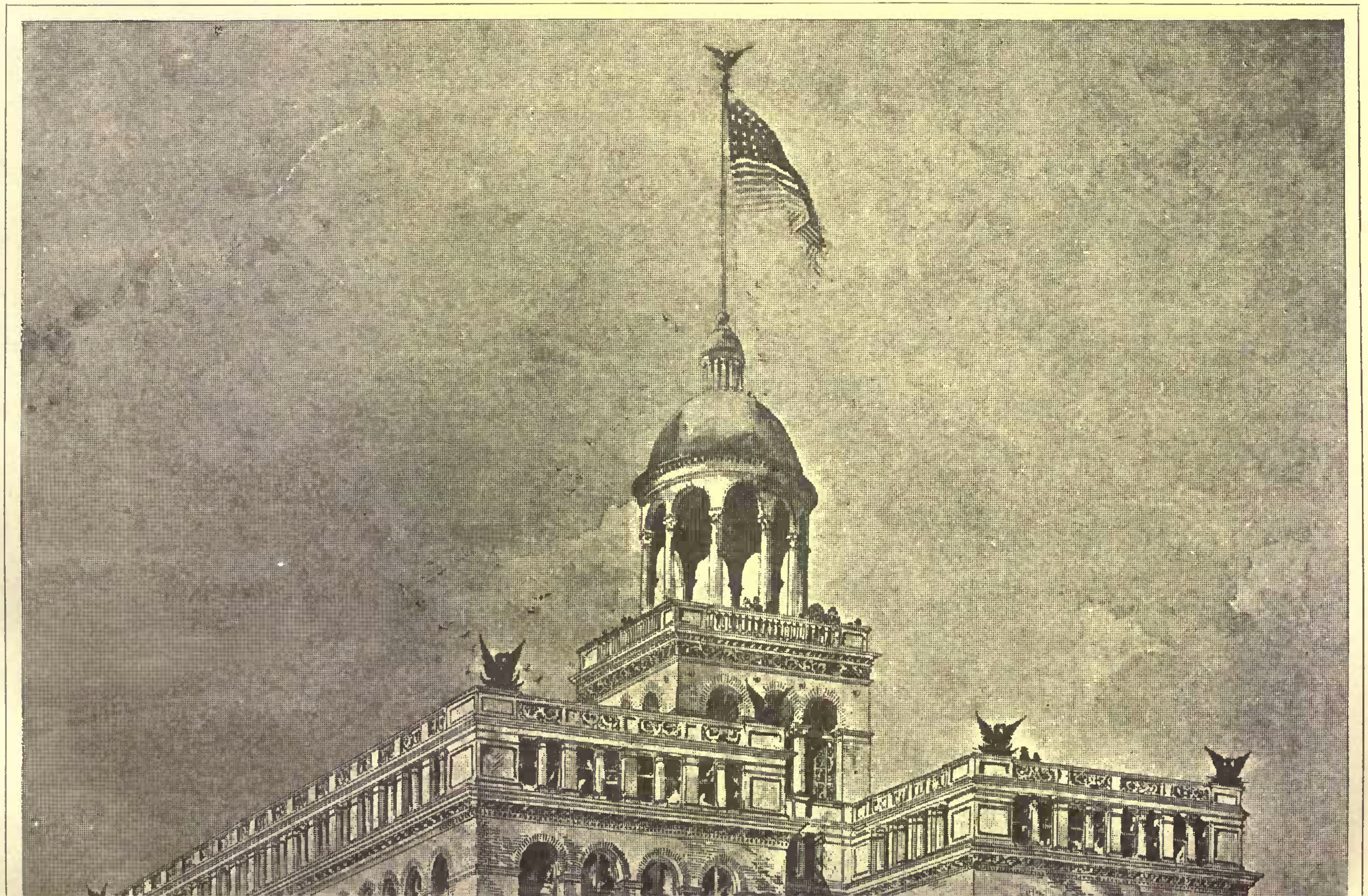


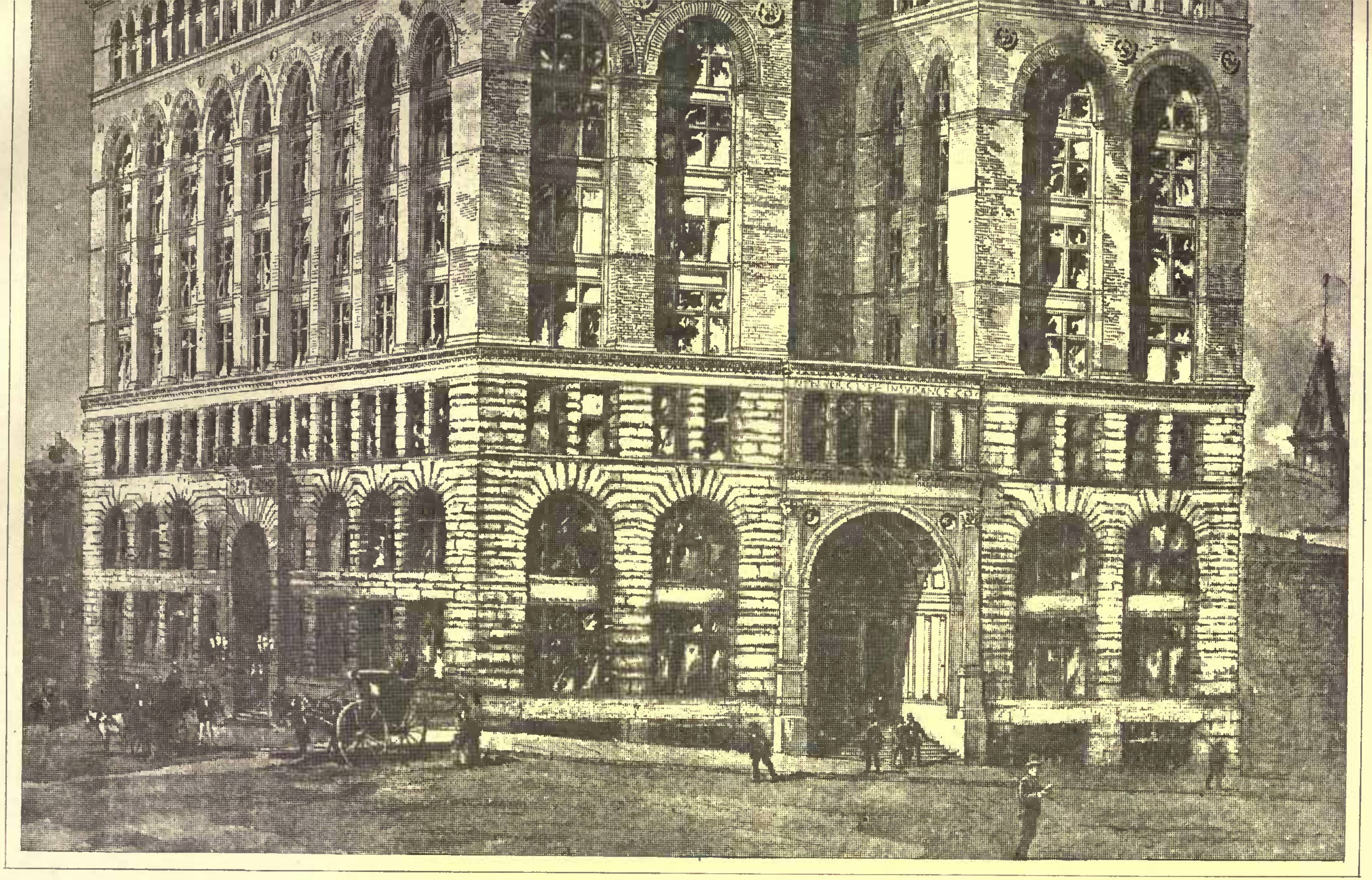


U.S. CUST. H? P. O. &c.
GALVESTON, TEX.

Heliotype Printing Co. Boston

M. E. BELL
Supervising Architect.





Heliotype Printing Co. Boston

New York Life Ins. Co's Offices, Kansas City, Mo.

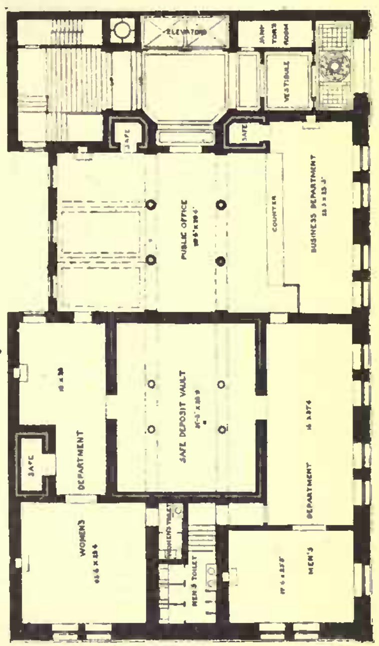
McKim, Mead & White, Arch'ts.


NEW ENGLAND BUILDING

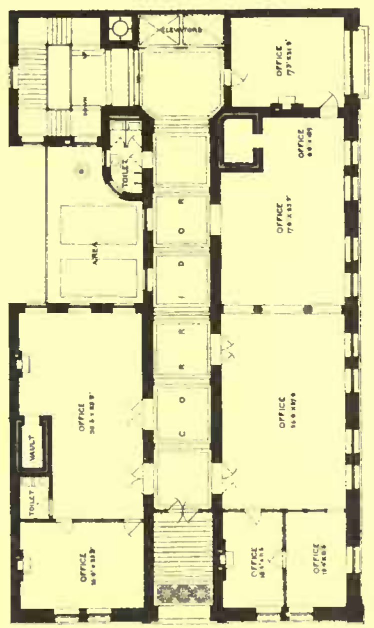


BRADLEE, WINSLOW & WETHERELL, ARCHITECTS, BOSTON.

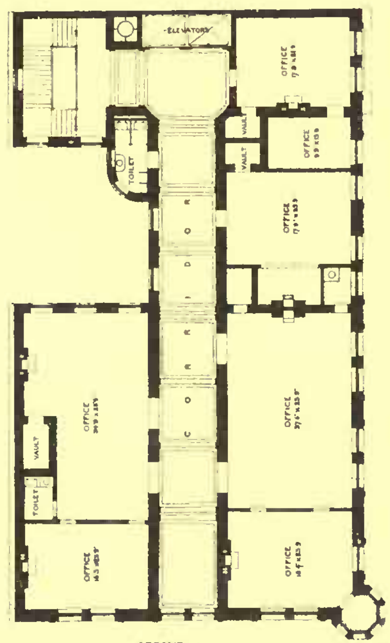
THE NEW ENGLAND BUILDING. KANSAS CITY, MO.



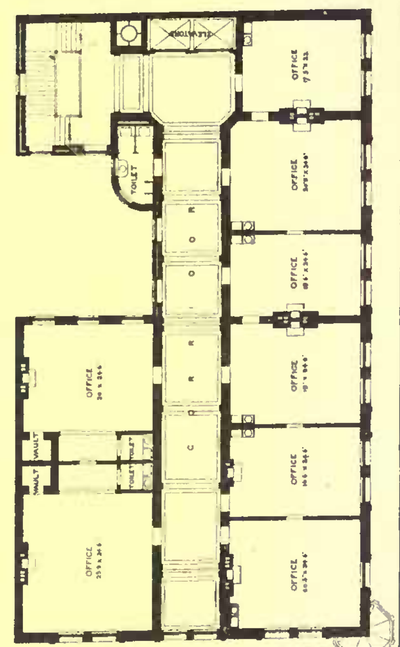
BASEMENT PLAN.



FIRST STORY.



SECOND STORY



THIRD, FOURTH, FIFTH & SIXTH STORIES



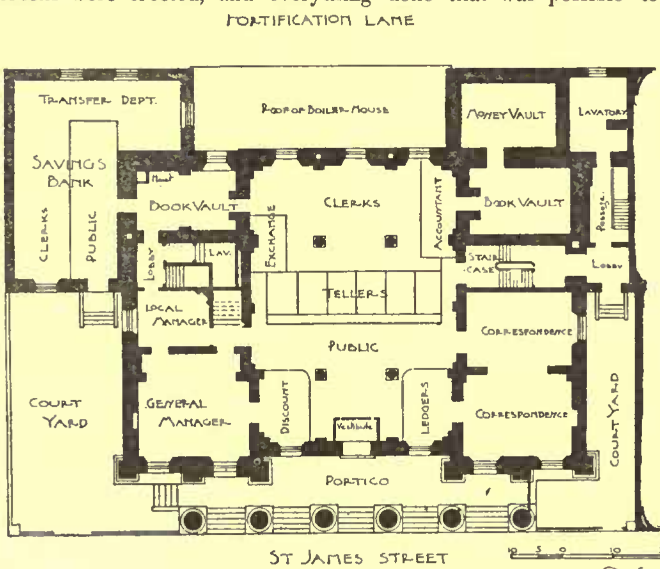
Heliotype Printing Co. Boston.

The Derby Building. Cin. O.

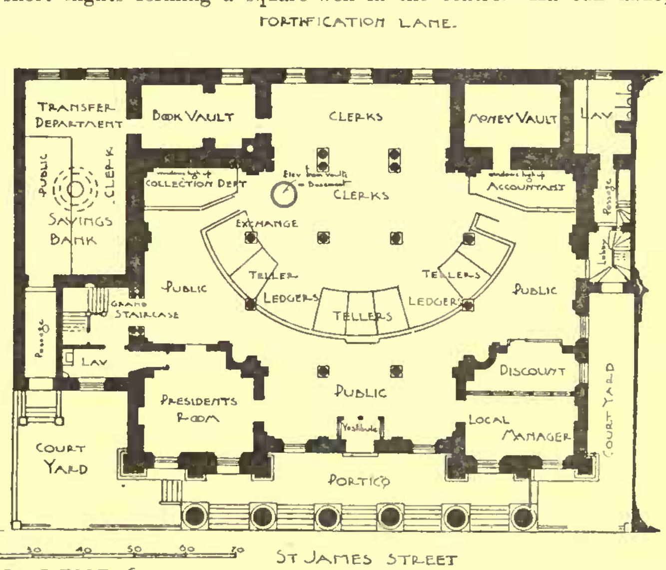
Sam'l. Hannaford, Architect.

the first floor. In the tympanum of the entablature are carved figures half-life size, representing commercial interests, etc., and having the arms of the bank in the centre. This was carved in Europe and brought out some forty years ago. The bank-building has long been one of the principal edifices in the city. For a time, only part of it was taken up by the business of the institution, the remainder being occupied by the dwelling apartments of the managers; but the business increased so rapidly that before long the tenants had to make way for clerks, and the whole of the ground and first-floor rooms were used as offices. The main office or banking-room was decidedly cramped, as will be seen by the plan. The six tellers' boxes occupying nearly the whole width of the room, leaving only a very narrow passage on each side for access to the Accountants' Department and Exchange Office. The ledgers were separated from the tellers, which is now acknowledged to be a very disadvantageous arrangement in banking business, and occupied a corner of the front of the room, while the Discount Department was in the corresponding corner on the other side of the door. It soon became a matter of necessity to enlarge the office, and then the question naturally arose, how could it be done to any appreciable extent, the only available space being apparently over the boiler-house at the back. Three or four architects were consulted, and the work was finally put into the hands of Messrs. Taylor, Gordon & Bousfield, of Montreal, Associates of the Royal Institute of British Architects. The main difficulty to contend with was that the site was bounded on two sides by streets, and on the other two by buildings so that no enlargement beyond the outside walls was possible, except at the back where the banking-room did not extend to the street. Another difficulty arose from the determination of the Directors not to move out of the building, while the works were carried on; this decision on their part made it necessary that the alterations should be carried out in sections, and this involved a great deal of expense. Dust-proof screens were erected, and everything done that was possible to deaden sound. Work was carried on day and night, all the specially noisy work having to be delayed till after business hours. The connections between the new parts and the old had to be made as far as possible by day, and completed through the night. Work was first begun on the right-hand side, on entering; the lower parts of the walls were cut away, and iron columns and girders substituted, to correspond in outward appearance with the original columns and beams. The iron cores of the columns beneath the wooden sheathing were wrapped with wire, and the interstices filled in with concrete to render them fire-proof.

The back extension was a more formidable piece of work, the lane being some twenty-one feet below the floor of the banking-room, and the soil being of a loose and shifting nature. The back wall rises to a height of eighty feet from the lane, and though apparently solid and substantial was found to be filled up in the centre with the veriest rubbish of building material, which made it all the more difficult to deal with. The upper half of this wall, forty feet high, had to be supported by heavy shoring, the shores on the outside of the wall being over forty feet long, carried down through the engine-house, and the subsoil to the rock beneath. The result of the work was most satisfactory, as when completed, not a hair's-breadth crack was to be seen. The whole back wall was cut out, and double columns supporting box-girders substituted. A glass roof with a flat ceiling-light below, formed the roof and ceiling of this extension. New vaults to take the place of the book-vault near the money-vault, which was swept away, were constructed up-stairs, over the passage leading to the clerks' lavatory, and for the support of these new walls had to be brought up from the basement. A new staircase, connecting with these vaults, and with the head office on the first floor was put in. The grand staircase in front of the Savings Bank, and the left-hand side extension of the office were next taken in hand; the entrance to the Savings Bank having to be kept clear for the public during the day.



Before Alteration.



After Alteration.

In planning these alterations it had to be borne in mind, that accommodation was to be provided to the utmost extent of the site, at the same time the main façade was not to be altered, and therefore whatever additions were made to the sides, they had to be kept in subordination to the front. The Transfer Department being larger than necessary, a part was taken off by the new book-vault in the rear; the Savings Bank was not enlarged, but turned round so that the clerks now occupy the place previously used by the public; this was desirable on account of the position of the vault, and made necessary by the addition of the grand staircase in front, which connects the office with the head offices and Board-room. The actual area gained for the office proper is about sixteen hundred feet, or three-quarters as large again as the former room. In the office a counter has been placed on a semi-circular sweep, made of various marbles, from the United States, from Belgium and from Italy, divided into panelled compartments by pilasters of immaculata, one of the most beautiful marbles known. The counter supports an ornamental screen of open bronze and bevelled plate-glass, wickets in the bronze-work being provided in the centre of each division. The ledger clerks have been brought within the pale, and placed between the tellers. The Discount Department is kept separate, and the Accountant's Department in connection with the money-vault is so arranged that from it complete supervision is obtained for the whole office. All the correspondence clerks have been placed in the rear, leaving only the President's room and the local manager's office in the front of the building. A mosaic floor, made by Messrs. Ebner & Co., of London, was imported and laid in the public part of the office; oak being used for the rest of the floor behind the counter, and parquetry flooring for the two rooms in the front. The grand staircase opening out of the banking-room on the left-hand side, and leading to the head offices on the first floor is of oak, with solid carved newels and balusters, and heavy hand-railing. It is arranged in short flights forming a square well in the centre. An oak dado, with occasional carved panels lines the walls. Near the top of the staircase is a recess, over the Savings Bank entrance passage, separated from the staircase by a colonnade of marble columns and pilasters, which serves the purpose of cloak-room for Directors attending meetings in the Board-room on the first floor. Colored glass made by Messrs. Guthrie & Co., of Glasgow, has been placed in all the staircase windows.

The bank was formerly decorated in white and gold. The new decoration carried out by Messrs. Herter Bros., of New York, under the direction of the architects, consists of deep reds for the walls, and dark greens for the wood-work relieved by scroll-work, and lines in gold and bronze. In the panels of the doors are bronze plates, six to each door, made by the Magee Furnace Co., of Boston. A frieze occupies the upper portion of the walls, which is of a more elaborate character than the lower parts, and contains eight mural paintings of events in the history of Canada. The panels of the ceiling are richly decorated in gold and color, on a silver-leaf background, which has an illuminating effect, and materially adds to the light of the bank. New windows of plate-glass in mahogany sashes, take the place of the old, which were divided into small panes. The whole bank is lighted by electricity on the Edison incandescent principle, run by engines and dynamos in the basement. Special brackets were designed for the lamps by the architects. New heating-apparatus has been supplied, and the whole system of plumbing and drainage overhauled and renewed. The ventilating of the bank has also been attended to: large fans in the basement draw off the vitiated air which is taken to the lane in the rear by a large ventilating trunk.

The desks and benches throughout the main office both for clerks and public are new, of mahogany, and made from the designs of the architects. Everything has now been done to render the building as commodious as possible for the transaction of business, and space has been gained to meet the requirements of the bank for a long time to come.

OFFICE BUILDING OF THE NEW ENGLAND MUTUAL LIFE INSURANCE COMPANY, KANSAS CITY, MO. MESSRS. BRADLEE, WINSLOW & WETHERELL, ARCHITECTS, BOSTON, MASS.

This building, containing about 8,000 square feet on each floor, is built of stone heavily backed with brickwork. It is to be as nearly fire-proof as possible, the floors being of iron beams with terra-cotta arches between, and the partitions of brick and terra-cotta. The basement will be occupied by the vault of the New England Safe and Deposit Trust Company.

OFFICE BUILDING FOR THE NEW YORK LIFE INSURANCE COMPANY, KANSAS CITY, MO. MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

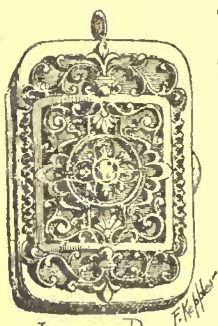
Materials will be red sandstone, brick, and terra-cotta. Structure will be fireproof throughout, and will contain all the appointments of a first class office-building. Cost will be about $800,000.

THE DERBY BUILDING, CINCINNATI, O. MR. SAMUEL HANNAFORD, ARCHITECT, CINCINNATI, O.

This building has recently been completed for Mr. H. W. Derby. It is of Zanesville pressed brick, with freestone trimmings, and in it the aim has been to obtain as much light as possible.

UNITED STATES CUSTOM-HOUSE AND POST-OFFICE, GALVESTON, TEXAS. MR. M. E. BELL, SUPERVISING ARCHITECT, WASHINGTON, D. C.

THE NEW THAMES TUNNEL.



Lady's Purse. Oxydized Silver Blue ribbed silk back-ground. Full size.

A REPRESENTATIVE of the *Pall Mall Gazette* having visited the new tunnel in course of construction between the Monument and the "Elephant and Castle," gives the following account of this remarkable work:

One striking feature of the new subways is their depth. They run right down underneath water and gas mains and sewers, and almost wholly keep to the line of the public thoroughfares, so that the projectors are not handicapped by heavy compensations, at one point only payment having been made. The depth under the roadways ranges from 40 feet to 45 feet, and under the Thames it is about 15 feet. Starting from the terminus, which will have a commanding corner position immediately above the Monument, the tunnels extend across the road, and passing down Swan Lane they enter the river bed at the Swan pier, about 50 yards above London Bridge. There are two independent tunnels, one for the up and the other for the down traffic. As Swan Lane is very narrow there was no space to place them side by side without encroaching on the contiguous property. The engineer has overcome the difficulty by running one over the other with about 5 feet of earth between, and gradually the lower one is raised until they run parallel, but separated by about 5 feet.

The work is being carried on from a temporary shaft sunk at the Swan Pier, with a depth of 60 feet to the first tunnel and 75 feet to the second, and having a diameter of 13 feet. Down this shaft we were swung, and at the bottom we found ourselves in a long iron cylinder 10 feet in diameter. At present it is dimly lighted with gas and lamps, but we could see ahead for a considerable distance, the tunnel taking a straight line. A temporary tramway for the removal of the excavated material and for carrying forward the iron plates with which the cylinder is built up, runs along the whole length of the subway. We found the path somewhat treacherous, for the passage of the greasy clay had made the boards very slippery. We arrived at the extremity, however, without mishap, and in a slightly-heated atmosphere watched operations.

The principle on which the tunnel is made was exactly pictured by the Irishman who, when describing the manufacture of a gun, said a hole was first made and then iron was put round it. A hole is cut into the clay and then, piece by piece, the cylinder is built up. And in this connection it may be noted that the London clay through which the subway will run its whole course is admirably adapted for the work, but at the same time sand or other loose soil can also be tunnelled with a slight change in the machinery and method. First of all, a small heading is driven into the clay and supported by timbers. With pick and shovel about 18 inches of the soil to the extent of the tunnel's circumference is next taken out, and then the "shield," as it is termed, begins work. This might be likened to the cap of a telescope, the telescope itself representing the tunnel in which the men are at work. Steel cutters are fixed round the outer edge of the cap (to maintain the simile) and hydraulic pressure (500 lbs. to the square inch) is brought to bear upon it from within, driving it into the clay. The hole, which was partially made by hand-labor, is thus rounded off, and the "shield" has been pushed forward in less than a quarter of an hour 18 inches. The "cap" is not wholly off the telescope, however. A plate of iron affixed to the "shield" covers the space bored until another section of the tunnel is added. Thus section after section is built up as the progressive movement is effected.

The circle is made up of six pieces, with a key-piece at the top. They are 18 inches wide and 1 inch thick, with flanges through which they are securely bolted together, and weigh about 4½ cwt. each. The metal is cast-iron, which will not corrode. The tube fits exactly to the shape of the hole which the shield has cut, less the thickness of the iron plate which the cap of the telescope typifies in the description. As the shield goes forward this hollow is filled with grout or liquid lime, which is forced through a hole in the iron plate by pneumatic pressure, and it very soon solidifies. There can thus be no risk of instability by the subsidence of the soil. In the matter of strength the engineer gave it as his opinion, when the bill was before Parliament, the question of weakening the foundations of London Bridge having been raised, that forty London Bridges piled on the top of each other would not damage the cylinder.

Something like 10 feet can be driven each day, and in sixteen weeks the Thames was tunnelled. The contrast with the ancient method is amazing. The first Thames Tunnel occupied about eighteen years, and although recent works have been more expeditiously completed, they have been much more prodigal of time than the one under review. The cost, also, can bear no comparison. Two hundred thousand pounds per mile is regarded as the ultimate cost, and including stations, land, and indeed every outlay, the authorized line of 1½ miles will be completed for £300,000. Hydraulic lifts will raise and lower the passengers at the stations, of which there are to be three, the intermediate one being at St. George's Church in the Borough, where the car-traffic for the city is emptied. If the extension beyond the "Elephant and Castle" is approved, stations will be placed at Kennington Park, Kennington Oval, and the terminus at Stockwell. This would add 1¾ miles to the line, which would mean an additional outlay of £250,000, or £550,000 in all for 3¼ miles.

All the details of working the line are not complete, but trains of three or four carriages, somewhat after the style of a tram or Pullman car, will be run, the motive-power being the endless cable. The cars will be more roomy than omnibuses or even ordinary railway carriages. A driver and conductor will be in charge of each train, which will carry about one hundred passengers. The carriages will be about 6 inches from the top of the tunnel, and about 1 foot 6 inches, measured from the centre, at the sides. They will start every two or three minutes, and the distance over the first section will be covered in six or seven minutes. The speed will be about double that of road conveyances. The machinery for working will be placed at the "Elephant and Castle." With respect to ventilation, the engineer anticipates no difficulty. There will be no foul smoke from engines, as in the case of the Underground, and, as the trains in each tunnel will always be running in one direction, they will create a current of air. If that, however, is not thought sufficient, a fan can be placed at the intermediate station, and by the expenditure of one horse-power the atmosphere in the whole of the subway can be changed every hour.

The promoters of the line, of course, believe it will pay. They are going in for cheap fares and fast conveyance, and with the enormous traffic to and from the city they have no fear of the result. A penny will be the fare on the first section, to the "Elephant and Castle," and another penny will carry to Stockwell. When the full distance is covered the company will have over three miles, and they will require one-and-a-half million passengers per mile per annum to pay all working expenses and five per cent on the capital. As the Metropolitan Railway, including its country lines, carries three-and-a-quarter millions per mile, there should be no difficulty in securing the numbers stated.

BOOKS AND PAPERS

KONDAKOFF'S BYZANTINE ART.[1]

THIS volume is the first instalment of one of those serious and exhaustive works that are the natural outcome of the modern scientific method. It is a scholarly effort to solve the "Byzantine question" by an elaborate study of the miniatures. These are so intimately connected with contemporary monumental art, and so often fill the gaps left by missing paintings and mosaics, that a detailed study of them is essential to a complete understanding of Byzantine art. Until very recently, remarks M. Springer, in his introduction, the manuscripts were studied without any regard to their contents, and the illustrations appreciated merely for their external value. No one ever dreamed of comparing the different illustrations of the same subjects, or of referring them to some common archetype; and yet there can be no doubt as to the utility of such collations. Just as the text of these manuscripts is based on certain primitive data, and just as their value is in direct ratio to their departure from the

[1] "*Histoire de l'Art Byzantin,*" considéré principalement dans les Miniatures, par N. Kondakoff, Professeur à l'Université d'Odessa. Edition française originale, publiée par l'Auteur, sur la traduction de M. Trawinski, et précédée d'une Préface de M. A. Springer, Professeur à l'Université de Leipzig. Tome premier.

prototype, so, too, the illustrations have a very ancient origin, shooting from a parent stem, whose ramifications it is easy to identify. Both writer and painter hold to a fixed original, though not entirely abdicating their independence. In the present work M. Kondakoff has so grouped and compared these illustrated manuscripts according to their titles and derivation, that for the first time we have an adequate view of a correlated whole, and by far the most brilliant history of Byzantine miniature yet written. That its author should be a Russian is natural; for an historian that is drawn to his theme through the sympathy of race and religion has an immense advantage over an alien, seeing that enthusiasm is often the most fruitful source of historic intuition. If, by chance, he errs on the side of exaggeration, criticism is always ready to temper it. But a native alone can grasp the spirit, and comprehend the true import of many facts, that can only be viewed and appreciated superficially by the stranger. That M. Kondakoff is not a Greek is true, and it is likewise certain that he was not born in Constantinople, "but the religion that he professes binds him by many ties to the ancient Byzantine civilization. Byzantine ideas are the secular patrimony of the Greek church, and Byzantine forms flourish even to-day in the Christian East. Putting aside their political aspirations, do we not see the educated Russians direct their glances towards the Rome of the Orient as towards their mother-country, and draw inspiration from her? Nor do they hesitate, in order to render this communion more complete, to penetrate the depths of Byzantine theology. The advantages of such a situation are very evident in the book of M. Kondakoff," to whom we are indebted, "if not for a complete history of Byzantine art, at least for a very valuable and substantial contribution to it."

If one may place any reliance on hitherto respected authorities, it is somewhat difficult to sympathize with M. Springer in his efforts to depreciate the effect of Byzantium on Western art. He makes light, too, of the pretended influence of the refugees from the fury of the iconoclasts in the eighth century, and that of the marriage of the Byzantine Princess Theophano with a German emperor in the tenth. His reasons do not seem to be sufficiently convincing to set aside the verdicts of such men as Müntz or Bayet. "It was precisely at the epoch of its decline," says the former,[1] "that the Byzantine school was called upon to intervene most efficaciously in the development of Western art." Then, after referring to the earlier Byzantine works at Ravenna and Siponte, he cites the mosaics in S. Maria in Cosmedin, S. Pietro in Vincoli, S. Venanzio — all in Rome, and of the seventh and eighth centuries — to substantiate his assertion. These mosaics were the work of Greek artists, some of whom were undoubtedly exiles from Byzantium. As to the marriage of the Princess Theophano, he says: "Towards the end of the tenth century, a veritable colony of Greek artists established themselves in Germany. They were drawn thither by the Princess Theophano, who married the Emperor Otho II in 972. The new-comers were not long in forming a school." Though it is difficult to accept M. Springer's conclusions in full, there can be no doubt that the Byzantine influence has been exaggerated. As he pertinently observes, we must not forget that all the art of the Middle Ages, Eastern as well as Western, is derived from primitive Christian art. This community of origin, the identity of scriptural subjects, and finally the adaptation of fixed artistic forms to a new style, account for certain external resemblances. The confounding of Byzantine with early Christian art has hitherto been the cause of many inaccuracies. "In imperial Rome, the eastern element had made constant progress, both in its customs and ideas; and is not the foundation of the new Rome in itself a signal proof of the triumph of Orientalism? Triumphant Christianity met with powerful auxiliaries in the instincts and dominant predilections of the East, and Oriental can scarcely be separated from Occidental art, especially from that of Italy, since it found there a second home. This is the reason why Christian primitive art presents so many common traits until the sixth century, and why it is very difficult to connect it with the East rather than the West. . . . The Greek language, in the first centuries of Christianity, had the authority of a sacred language; the Latin, on the contrary, was deemed the language of State, even after the translation of the seat of government to Constantinople. In our opinion, this dualism penetrates all the ancient Christian civilization, and consequently, too, the development of the arts. And this civilization lasted as long as the dualism in question. But, as soon as the latter disappeared, and the Roman church made Latin its official language, and the empire found itself confronted with the inextricable complications of the East, as well as with such an adversary as Islam, then Western art was separated from Eastern, and Byzantine art, properly called, was born."

It is to be regretted that M. Kondakoff's book is not more fully illustrated. He presupposes an acquaintance, on the reader's part, with certain famous MSS., that are scattered through the different libraries of Europe — an acquaintance which should be frequently renewed in order to make a satisfactory collation of their contents. But to institute even such comparisons one must depend mainly on fallacious memory; and herein lies the utility of the modern reproductive processes, which, though giving pictures not absolutely identical with the originals, are yet enough so to aid us very materially in those researches that call for a detailed mechanical knowledge of a vast number of inaccessible works. Had but a few trustworthy reproductions, instead of the small number of inadequate linear interpretations, been inserted in the book — as well as a few colored prints to illustrate the frequent references to certain characteristic tones — many dreary pages would have been enlivened, and the reader spared a great deal of arid descriptive and — in the absence of illustrations — meaningless lore. One derives about as much satisfaction from some of the text, as, let us say, from Homer's "catalogue of the ships." Out of this erudite mass, I shall endeavor to extract a few nuggets of information that may prove interesting to the average reader.

The Byzantine miniatures — by which name are designated the colored illustrations of the Greek manuscripts, from the fourth century to the fall of the Eastern Empire — are of prime importance, from an historical point of view, inasmuch as they form the basis of the study of a school that has played an important rôle in the development of art. Not that this school has been barren in other departments; for immense monumental mosaics in the Byzantine churches of Ravenna, Constantinople, Salonica, Venice, the towns of Southern Italy and of Sicily, hold the highest rank in its annals. Then come those wonderful sculptures in ivory, those varied works in metal, the inimitable enamels of a later date, and, finally, the rich brocades of gold — all of which are to be found in Western collections. But between the mosaics of Ravenna and Salonica, on the one hand, and those of Venice and Southern Italy on the other, there is an interval of five centuries, completely wanting in monumental works. It is this lacuna that the miniatures fill up, offering us, in fact, an uninterrupted series of productions from the most remote period of Byzantine art down to the last days of the Empire. They form an important and independent branch of art, with a strongly emphasized popular character. They are not merely, as some fancy, the haphazard creations of lazy monks, purely subjective in character; on the contrary, they have an objective and historical import, holding their place in the artistic movement of the epoch; so that in studying them according to their natural and historical groups, we can not only reconstitute the complete history of Byzantine miniature, but of Byzantine art as well.

In the classification of the manuscripts, due recognition must be taken of the literary element, apart from that of time. Heretofore it has been slighted, and, for this reason, all previous classifications have been unsatisfactory. In neglecting this important side of the question, the historians broke the natural bond that united the text and illustrations. Such and such a miniature translates such and such a thought in the text, and often, too, interprets the theological ideas of the day, which are given free scope in this sort of composition, and are incorporated for the first time in an artistic form. Once adopted by the miniatures, these new subjects are accepted by monumental painting. "But apart from this theological coloring of the day, the miniatures are stamped with an individual character, betraying at the same time both the love of art and religion. It was in the miniatures that persecuted orthodoxy took refuge; it was in them that religious enthusiasm blazed out in all its energy. In the midst of the elegant and brilliant, but mindless art, that was cultivated at the court of Byzantium, miniature was, perhaps, the only asylum for every free man belonging to no corporation, and seeing something else in the arts than manufactured products. The numberless scenes and figures of the commentated Book of Psalms, so different from the showy, but monotonous and tiresome court Menologies, offer us an inexhaustible historic mine, and a symbolism of the highest interest; they present to us the public and monastic life of the epoch. In this respect the miniatures completely eclipse contemporary mural paintings and mosaics. The *mosaïste* neither invents new types, nor new attitudes, nor new arrangements of draperies; the forms he treats are, so to speak, immutable; abdicating his rights as an artist, he reproduces them with servility. If there is decadence in the reproduction, it is because decadence is universal, and it is essential that a country should be in a period of exceptional splendor, to give birth to imposing works in this department of art. Miniature, on the contrary, is much less affected by the disasters that befall the State, and does not decline, for the very reason that all about it is enfeebled and in danger."

It is a mistake to attribute the development of the miniatures, as many have hitherto done, to the protection of the Byzantine Court; for to-day we have abundant data to prove that this pretended protection had in reality but little importance. They were fostered in the convents, especially in the richer ones, where the allied arts of calligraphy and illumination were practised on a vast scale. The importance of monachism in the East, and especially at Byzantium, from the commencement of the eighth century, is well known. Having become invincible in the church, by reason of their asceticism, the monks devoted themselves to intellectual labor, whilst combating heresy. With the help of philosophy, the theologians acquired a more intimate knowledge of the Scriptures, and exercised their oratorical powers according to the classic models of eloquence. While the scholarship of the cloisters steadily declined in the West, after the beginning of the fifth century, only to be artificially resuscitated in the Carlovingian epoch, it was, on the contrary, the mainstay of the Greek church during its struggle with the iconoclasts in the seventh and eighth centuries. It must be remembered, however, that this monastic asceticism was a very different thing from the ordinary abnegation which is peculiar to Oriental asceticism, and delights in a solitary and independent existence. Ardent and active, it consolidated the church and held society together in times of stress. Nor did it encroach on that assemblage of doctrines founded on the conception of a free church, and which the Greek monks

[1] "*Etudes sur l'histoire de la Peinture, et de l'Iconographie chrétienne.*"

defended even against the pretensions of emperors. It conquered for itself an enviable position at Byzantium by the side of literature and art.

The annotated Byzantine manuscripts of the eleventh and twelfth centuries are the most numerous; then calligraphy was at its zenith. Those of the fifteenth and sixteenth centuries are likewise very numerous, but of no especial interest; while those from the sixth to the ninth century are extremely rare. Yet, it is precisely during this epoch that every name, the slightest remark or annotation is of capital importance for the history of the development both of Byzantine art and Byzantine miniature. But notwithstanding this dearth of reliable data, we glean here and there scraps of general information that are by no means valueless. They seem to indicate the southwestern provinces of the Eastern Empire as the focus of calligraphy in the most remote period of Greek paleography. The existence of the library at Alexandria, the wealth of the Egyptian episcopacy, its influence in Palestine and the neighboring provinces, its traditions, the prestige of its ancient civilization, and finally, the number of its paleographic details, all prove the Alexandrine preponderance in the Christian East of the first centuries. It is fair to assume, then, that the earliest illustrated manuscripts of the book of Cosmas Indicopleustès, among others, either appeared at Alexandria or in the author's country. Nor is the very evident resemblance of certain well-known manuscripts, such as the *Codex Sinaiticus*, the Vatican *Cosmos*, the fragments of the Vienna and London bibles, etc., the result of mere chance. Among the manuscripts illustrated at Constantinople, the book of Dioscorides, and possibly one or two of the rich seventh and eighth century manuscripts, which cannot be designated with certainty, alone belong to this category. There is absolutely no date, no precise information to determine the rôle played by Asia Minor in the history of Greek calligraphy before the tenth century. We can only suppose that the artistic movement took a northwesterly course from the southeast, to concentrate itself in the capital of the empire. During the heat of the iconoclastic struggle there was a certain taste for the arts at Constantinople; while the Oriental provinces, which for centuries had striven to defend religious art, were gradually becoming isolated, and losing their civilization. The influence of the East was certainly felt in the capital at this time, but the latter was the centre of artistic development. Towards the close of the iconoclastic heresy, between the eighth and ninth centuries, the illustrated "Psalter," the first book designed for the instruction of the ignorant masses, was issued from the monastery of St. John Stoudios at Constantinople, famed for its defence of orthodoxy. It was deemed necessary to convince the heretics that this so-called industrial art could be of real service to religion. Notwithstanding a number of exceptionally splendid manuscripts destined for the court, the aim of the art of Constantinople seems to have been its popularization. Manuscripts in the Byzantine manner are to be found not only in the monasteries of Mt. Athos, but also at Jerusalem, in Armenia, Southern Italy, and Sicily. The masters of Constantinople strove, not to perfect, but to multiply their miniatures, as they did their mosaics. Hence the origin of that careless art, rich in ornament but poor in ideas, which is so apparent in the numberless Menologies and Gospels that are still extant.

The Latin invasion (1204) transferred the centre of calligraphy and miniature to Asia Minor and the islands. In the fourteenth century Constantinople is almost sterile, while the rustic miniaturists of Rhodes and Cyprus, of Trebizond, of Greece and the Calabrias vie with each other in zeal. Thus it is easy to account for the decadence of the fourteenth and fifteenth century manuscripts. Instead of a refined and delicate ornamentation, we have nothing but childish scrawls; the brilliant coloring of the past is replaced by dull and sombre tones. Nor are the subjects the same. Such themes as the Book of Job, the Life of Alexander the Great, and chronicles of all kinds, tempt the miniaturists. These are the books henceforth destined for the artistic and religious education of the laity that succeed the brilliant models of the eleventh century.

After the taking of Constantinople by the Turks (1453) the miniaturists of its convents are dispersed over the four quarters of the globe, some seeking an asylum in Rhodes, others at Venice; some on Mt. Athos, others in England, Trebizond and Tuscany. They transmit to the renascent West the knowledge rescued from the wave of barbarism in the East. Many of these celebrated workers are to be met with in Crete and Venice, where they turned out volumes by the hundreds, whose beauty recalls the early Alexandrine books, but which, unfortunately, are useless as far as the history of an art is concerned, that ceased to exist long before the destruction of the capital.

With the early Byzantines, the veritable successors of the classic Greeks, reflection always dominated the imagination and prevented them from passing the limits of their scholastic philosophy, and, at the same time, of common sense. The monks bear but few traces of that mysticism which generally characterizes the clergy, and especially of Oriental mysticism. What little there is of it is national rather than esoteric, and entirely in accord with the popular tastes. Thus the illustrations of the Psalms, of the Book of Job, of the Fathers of the Church, etc., were not simply a commercial production, the fruit of monastic leisure, but works that corresponded to the veritable religious wants of the people.

From the ninth century iconography assumes a "lyrico-didactic" character, the confused and involved commentaries on the parables being the immediate result of this new tendency, and of which miniature felt the effects more decidedly than the other arts, owing to its intimate relations with literature. For this reason, too, it began, toward the close of the eighth century, to enact the leading rôle. During the iconoclastic quarrel the artists were wont to produce works of small dimensions, till at length miniature was preferred to monumental art, and creative talent manifested itself in microscopic compositions.

"As a conclusion," remarks M. Kondakoff, "to this birds-eye view of the historical development of Byzantine miniature, let us say that it followed every phase of Byzantine art, and that after the primitive period (IV–VII centuries) it even raised itself to the first rank and exercised its influence on the other branches of art. Till now, and without exception, this important fact in the history of iconography has escaped the notice of all the archeologists." In the subsequent pages the student will find a learned and exhaustive description of extant Byzantine manuscripts, beginning with the famous "Dioscorides" of Vienna (A. D. 500), as well as an instructive account of their Greek prototypes; the "Iliad" of the Ambrosian Library, the "Virgil" of the Vatican, fragments of the "Genesis" of Vienna and of "Cotton" of London, the roll of "Joshua, Son of Nun," of the Vatican — all of the fourth to the sixth century. The reader will also find an elaborate exposition of that somewhat subtile question, the effects of iconoclasm on the fine arts. As to its influence on miniature I shall, in conclusion, quote a single paragraph from the author's remarks. "Some have pretended that the iconoclasts developed miniature; the monk, they say, in limning his images, found therein the means to satisfy his artistic tastes. But they forget that the costly manuscripts were executed for persons of rank, either as commissions, or as gifts from the convents. As to the convents themselves, they were content with much simpler manuscripts." Yet it must be remembered that if iconoclasm lowered the artistic standard of miniature, it did much for its diffusion.

Frederic Crowninshield.

COMMUNICATIONS

THE LABOR QUESTION.

To the Editors of the American Architect: —

Dear Sirs, — Permit me to challenge the attitude that you assume, in your editorial comments, toward the labor movement that has arisen in late years, and that just now receives so much attention.

If you at all trace in your mind the variety of allied movements that are intimately associated with this labor movement, the new ideas that are preached and welcomed in all circles of all countries throughout Western civilization, you will, I think, admit that the view which merely condemns the great mass of citizens as stupid, ignorant, blind followers of mercenary, selfish leaders, is scarcely broad enough to command a proper understanding of the forces that are approaching the field.

I am not about to question the assertions that you make in any particular article, because, from your point of view, your assertions are substantially correct. It is the point of view which I would change.

Look at things from the same point of view, and agreement is inevitable between men of honest heads and sincere hearts.

There is much talk in our books of political economy about the necessity for cheap labor that we may compete in the markets of the world.

Cheap labor is all very well so long as we are urging the importance of somebody else working cheap. But how do you feel, Mr. Editor, when a client delicately suggests that Mr. Cutunder will do the work for half of your five per cent? "Cheap labor," "Free competition," doesn't sound quite so attractive then, I fancy.

After all, if by economy and prudence and forethought and by abstaining from league dinners and champagne; by getting up early and going to bed late, an architect can do work cheaper than another, why, by the great Adam Smith, should n't he? Is not that free competition? Are not our gentlemen of the M. I. T. destined to go down before the competition of the able and economical Dutchman unless they can underbid him?

Is there not a vast outlying realm of possibility in the Chinese draughtsman and architect, whom we may shortly see, who will regard $200 a year as princely?

I speak in dead earnest. Architects are indisputably workingmen in the economical sense, and the reward of their labor is technically wages, just as much as the dollar a day of the brick-cleaner. For architects do productive work. They add to the value of the raw material by their labor.

This is what constitutes the distinction between the laborer and non-laborer. The work of the one is productive; of the other is non-productive. A man may work hard all his life, using the best powers of an athletic body or acute brain at speculation or aboard ship under the black flag, without deserving the name of worker, because he gives nothing for what he takes.

So that the cause of the architect is one with the cause of the bricklayer.

What is the result if all architects are compelled to give full service for three per cent, or two per cent, or one per cent, for the cheaper, the better, says political economy, instead of their five per cent?

The one paramount result will be that they must reduce their scale of living.

That is, they must eat pork instead of sirloin, and only half-a-pound where it was before a pound. The nutritious bean must take the place of the riotous cauliflower and asparagus. Beer must content the palate that delighted in sauterne and burgundy. Pipes must oust Henry Clay's. Libraries must cease to grow. Old clothes must assume an unwonted charm. Wives must go in calicos and babies abjure needlework on their pantalettes.

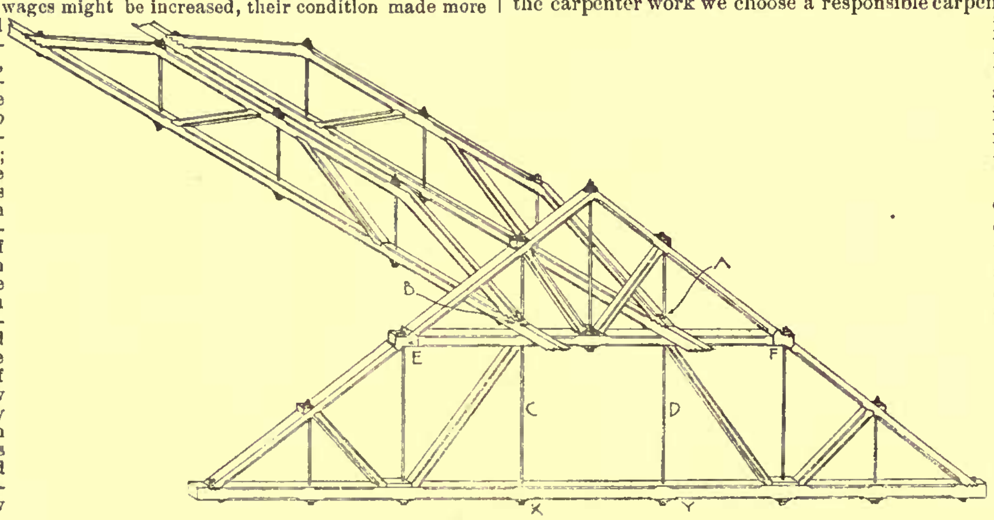
And the result of reducing their scale of living will be to reduce the scale of living of somebody else. The grocer will make less money; the butcher will find his sales reduced; the baker and candlestick-maker will find the market growing duller.

For every reduction in wages to one means a reduction in his consumptive power. The advantage that one manufacturer or builder gains by a cut in wages, or an increase in hours, means closing the market to some other manufacturer, because the men have not the means to buy so much as they bought before. The second manufacturer must reduce his expenses so as to sell his goods cheaper, must cut the wages of his workmen, which again reacts; and there is no end to the grinding-down process.

Speaking as an architect to architect, as a worker to worker, I ask consideration of this proposition in contradistinction to those of the "dismal science."

The cheaper the products of labor are, that is, the more that is produced by labor, the dearer the labor itself ought to be, that is, the higher wages ought to be. JOHN BEVERLEY ROBINSON.

[THERE is no sentiment in regard to the labor question that we have expressed more strongly or more frequently than the wish that the income of those who work for wages might be increased, their condition made more comfortable, and their future more secure, as fast as they, and the able and persistent men who are doing their best to help them, can accomplish that object; but we do not see how midnight oaths of allegiance to such loathsome scoundrels, as are many of those who fatten on the misery of the poor people whom they hold in subjection by lies and threats, are to raise the condition of workingmen; or how they are benefited by exhibitions of such wanton tyranny as that which ordered seventy-five thousand men in New York and New Jersey, a few weeks ago, to abandon their work, and the living of their families, without any conceivable reason except to show the power of the men to whom they had been foolish enough to swear obedience. Mr. Robinson thinks that we "condemn the great mass of citizens as stupid, ignorant, blind followers of mercenary, selfish leaders." Let us say frankly that he is not very far from right. We might soften his terms by saying that we think the majority of our fellow-citizens to be trusting, inexperienced, and faithful to a degree which exposes them to all sorts of fraud and terrorism, and it is their very simplicity and unselfish ness which should commend them to the protection of those better acquainted with the ways of the world. We are not at all ashamed to say that for examples of the most perfect purity, honesty, and faithfulness that the world can show, we must look, as we think, to the class of our fellow-creatures who live upon their daily wages. But in the continual movements and demonstrations which we have lately been compelled to witness we cannot help seeing myriads of happy little families plunged into destitution, the lives of thousands of women made miserable with privation and terror, and the characters of men degraded by tyranny and despair. If any good has ever come out of the colossal strikes, of which agitators are so fond, sufficient to pay for the misery which they cause, we have not yet heard of it, and until we do hear of some such great advantage, we shall be likely to hold to our unfavorable opinion of the practice of blowing up street-cars with dynamite, or fracturing the skulls of their drivers with bricks, or of placing hand-grenades under the seats of ferry-boats, or carpet-bags full of lighted bombs in the cabin of steamboats, or the other similar devices by which men with families dependent upon them are kept in the state of subjection, which appears to be necessary to the management of labor organizations. — EDS. AMERICAN ARCHITECT.]



A Roof-Truss Strain.

A ROOF-TRUSS STRAIN.

BALTIMORE, MD.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you kindly give an opinion, through the columns of your journal, as to whether the piece E F, in the large truss, as per enclosed tracing, is in compression or extension? Also, whether there should be a nut and washer at points A and B on the rods C and D, or not; and, if so, whether above the piece E F or below it? The two cross-trusses carry all the weight of the roof to the points A and B. Yours, "INQUIRER."

[E F is in compression, whether there is a nut and washer on the rod or not, although the strain varies somewhat in the two cases. We should not advise putting a nut and washer on the rod, either above or below E F, but instead of this would very strongly recommend putting counter-braces in from E to X and F to Y. — EDS. AMERICAN ARCHITECT.]

BUILDING ACTS ANTICIPATED.

The following is an extract from a letter written in 1787, and refers to houses just built by Franklin in Philadelphia. J. A. F.

"I lament the loss your town has suffered this year by fire. I sometimes think men do not act like reasonable creatures, when they build for themselves combustible dwellings, in which they are every day obliged to use fire. In my new buildings, I have taken a few precautions, not generally used; to wit, none of the wooden work of one room communicates with the wooden work of any other room; and all the floors, and even the steps of the stairs, are plastered close to the boards, besides the plastering on the laths under the joists. There are also trap-doors to go out upon the roofs, that one may go out and wet the shingles in case of a neighboring fire. But, indeed, I think the staircases should be stone, and the floors tiled as in Paris, and the roofs tiled or slated.

"BENJAMIN FRANKLIN."

A PLEA FOR BETTER STONE-CARVING.

CHICAGO, March 22, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Probably nothing on the exterior of a house adds so to its individuality and heightens its artistic effect as the carving, whether in stone or brick.

Yet, in the execution of such carving, it is seldom that the same care is exercised in seeing that the work is executed by competent men as is used in other departments of building.

In selecting a painter we choose one who has standing as such. In the carpenter work we choose a responsible carpenter — yet in carrying out the carving how rarely is the work entrusted to a carver of standing — one socially responsible for his work.

Generally, we include it in the general stone contract, thereby letting it to a man whose only object in doing the work is the ordinary business idea of doing it as cheaply as possible. A man not supposed to be an artist, and whose object will be to do the carving as cheaply as may be consistent with passing the architect.

The architect, for his part, is often pressed for time, and does not usually see the work until in the building; then, if he is not pleased with it he will accept it under protest, being reluctant to delay the building by having it pulled out and replaced by better work.

In our city of Chicago we can see two striking examples of the two cases in question. Compare the carving of Mr. Borden's residence on the Lake Shore Drive to that on the Art Institute. Mr. Hunt thoroughly understood the impossibility of the work being done to his satisfaction if included in the cut-stone contract. Had he done so the carving might have been a reproduction of the abortive work seen on the Art Institute. The latter building is a fair example of the way work is done in Chicago. The carving was included in the stone-cutters' contract, who probably knew no more about carving than a Roundhead, and cared less. The result we can see. Chicago has made immense strides in art matters in the last few years, and it is to be hoped that people building will, in the support and elevation of a taste for higher art, see to it that the carved work on their buildings is carried out in an artistic manner by competent workmen. NEMO.

WOOD-BLOCK FLOORING.

ST. PAUL, MINN., March 26, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Can you give the names and addresses of manufacturers of wood-block flooring in this country?

Very truly yours, C. C. C.

[ADDRESS the Wood-Mosaic Co., 318 Scio Street, Rochester, N. Y. — EDS. AMERICAN ARCHITECT.]

RE-BURNING A KILN OF BRICKS.

QUICKSBURO, VA., March 3, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Last September I had a kiln of 154,000 brick burned, by men who did not understand their business as they should, and as a consequence only one brick in five is hard; the others are scarcely good "salmon." Will you please tell me if I can re-set the soft ones this spring, and re-burn them and make good brick of them, or, if not good,

at least fair brick? The kiln has stood open to the weather all winter' and a great many of the top courses have burst and crumbled, but I think the great body of them are still solid. You gentlemen have all these matters at your finger's ends, and know them as well as I know the multiplication table. Please write me a few lines, and greatly oblige, Very truly yours, J. H. KAGEY.

P. S. Size of brick, 9 x 4½ x 2⅝ inches. My proposed house is to be two stories, with cellar; 18″ wall for cellar, 13″ for remaining outside walls, and 9″ partition walls; 10′ ceilings. J. H. K.

[MR. CHARLES F. DAVIS, to whom we submitted this question, replies that the kiln of bricks can be re-set and burned, and if properly fired will make a good quality of building-bricks, provided the bricks were made from medium-strong clay. In re-setting the kiln of bricks, it would be desirable to use burned bricks for the first three or four bottom courses of the arches, and the least burned of the bricks for the other straight courses, and for the overhangings, placing the best of the partly-burned bricks upon the upper and lower benches of the kiln, and the worst around the heads or sides of the kiln. It would be well to employ only a good man to burn the bricks if they are re-set. — EDS. AMERICAN ARCHITECT.]

BOOKS FOR STUDENTS.

SAN FRANCISCO, CAL., March 12, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Having noticed in your valuable journal a list of the best twenty books for an architect's office, I would like to inquire of you whether these books are suitable for a student to commence on? If not, please inform me, through your "query" column, the titles of some of the best books on the constructive and decorative part of architecture. Hoping that this may be beneficial to a hundred or more students, as well as myself, who have not the advantage of attending an architectural school, I remain,

Yours, "STUDENT."

[IF "Student" will turn to the list of the "best twenty books," published February 12, he will find the following books in the list as well suited to his needs as any that can be found. We place them in the order which a student would naturally follow: VII, X, V, II, XV, XI, I. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

PORTLAND CEMENT IN IRON SHIP-BUILDING. — Portland cement has often been described as the very life of an iron or steel ship; and considering that, as a rule, the tendency to wear and tear from corrosion is much greater on the inside than on the outside of their plating, the substance in question is, says the *Engineer*, fairly deserving of the confidence reposed in it. If the cement is good and well looked after, the inside surface of the plating from bilge to bilge can suffer no injury whatever from the usual acid water lying in the limbers. Ships have been known to "float upon their cement," one case in particular being that of an old passenger steamer, which, when examined in the graving dock by striking the bottom with a hammer, yielded so dead a sound at one place that a closer inspection was made, revealing the unlooked-for fact that cement and not iron was being struck. The bottom plating was, indeed, wholly wasted by corrosion at the place which was struck, but so hard was the cement that only by many and vigorous blows was it broken. But cement was cement in those days, and not the adulterated mixture one sometimes comes across in this degenerate age. Moreover, sharp, fresh-water sand was used in mixing such cement as that, and not the dirty saline substitute now too commonly employed.

RUSKIN VANQUISHED BY A MASON'S TROWEL. — Mr. Ruskin, in the latest volume of his autobiography, says: "When I had to direct road-making at Oxford, I sate, myself, with an iron-masked stone-breaker, on his heap, to break stones beside the London road, just under Iffley Hill, till I knew how to advise my too impetuous pupils to effect their purposes in that matter. I learned from an Irish street-crossing sweeper what he could teach me of sweeping; but found myself in that nearly his match, from my boy-gardening; and again and again I swept bits of St. Giles' foot-pavements, showing my corps of subordinates how to finish into depths of gutter. I worked with a carpenter until I could take an even shaving six feet long off a board; and painted enough with properly and delightfully soppy green paint to feel the master's superiority in the use of a blunt brush. But among all these and other such studentships the reader will be surprised, I think, to hear, seriously, that the instrument I finally decided to be the most difficult of management was the trowel. For accumulated months of my boy's life I watched bricklaying and paving; but when I took the trowel into my own hand, abandoned at once all hope of attaining the least real skill with it, unless I gave up all thoughts of any future literary or political career."

THE DRAINAGE OF VENICE. — Venice has taken up the question of sanitation, and the *Istituto Veneto* has inaugurated a discussion on "the drainage of cities in relation to endemic and epidemic maladies, with general reference to the drainage system existing in the City of Venice and the modifications to be made in it in the limitations imposed by the special topographical conditions of the city, with the scope of its application to the sanitary needs of the city." From a brochure on early drains in Venice, just published by the well-known Venetian architect, Giacomo Boni, I translate the following passages: "In December last our Municipal Council voted a tax on private sewers proportional to the damage they do to the banks of the canals, which encourages the use of cesspools. It is necessary, however, to regulate the construction and emptying of these. There are many things to be noted concerning the construction of drains. The worst of their inconvenience is the deterioration, after a long time, of the subsoil of a house or entire city, where the air circulates and comes out charged with exhalations, where infectious germs find conditions favorable to reproduction and development, because in land under human habitation, as in the earth of cemeteries, after a time the reducing agents are exhausted. From the point of view of health, to this use of cesspools in earth already saturated, we should prefer the harmless custom of the fisher population of some of our islands, who throw everything into the canals, where the salt water, solvent *par excellence* and universal disinfectant, takes charge of the consequences. In the special case of Venice, where the sea-water floods the land, we must study what its disinfecting properties may be, what its action filtrating through the porous strata of the subsoil of our city, and how this action can be best utilized for general advantage without any intention to trifle with the cleanliness of our canal. Cesspools surrounded by sea-water, or by a soil through which the sea-water filters freely, will operate better than those of presumed impermeability." It seems to me that the earth-closet is a device eminently fitted for Venice. In any case, it is gratifying that the Venetians have, like the Romans, taken up the question seriously without waiting to be driven by the foreign press.— *The London Standard.*

TRADE SURVEYS

THE oversold condition of at least one-half of the industrial capacity of the country is the cause of the great increase in projected enterprises during the past month. The profitable disposal of every square foot of house-room erected last year is the cause, in part, of the present activity in house-building. The extraordinary demand for all kinds of building materials is the reason for the projected expansion of manufacturing capacity in the department of building supplies. Activity in railroad-building has other and deeper causes than simply good dividends. The expanding demand for all things which enter into the establishment of facilities for traffic is the most notable feature of the wide-spread and deep industrial and commercial activity. Here are a few sample details, collectively indicative of extraordinary industrial vitality. Locomotive-works are working on orders for over four hundred engines. Car-builders have contracts for eighteen thousand cars. Boat-yards have three to four months' tonnage to build. Rail-makers have eighteen thousand miles of road to furnish, including work done this year. Within a week bituminous-coal contracts for three million tons have been placed, or practically placed. Machinery-makers are now piling up orders for engines for home demand and export, which cannot be safely approximated, owing to the absence of proper book-keeping; but the rush of orders for special and ordinary machinery is, on the highest authority, at least twenty-five per cent above last year's business at this date. All manufacturing interests agree that the incentives to increase production are safe and likely to be more permanent than in former seasons of expansion. Business has been quiet at iron and steel mills, moderately active in textile mills, very active in implement, tool and wood-working industries, overcrowded in hardware, chairs, and light machine-shop requirements, unprecedentedly active in lumber and fairly active in all other building material.

Besides, terms have been definitely made with three-fourths of the trades at least, and there is no disposition to break faith. It is true the desire for an eight-hour day is general and under favorable conditions would lead to a general effort to establish it, but the heads of the Unions do not care to risk their credit and positions by suggesting, or even encouraging agitations at this time. Builders are entering upon their work with activity. Steady prices are assured. The strengthening-tendency in real estate helps rather than injures the building fever. There are demands for all the houses that can be built in cities, large and small. Never before in the history of the Western lumber trade, especially, has there been such a vast movement of lumber as during the last two weeks of March. All markets, from the Atlantic Coast to Omaha were liberally supplied. At Omaha the supply is spoken of as a "deluge" of lumber. A wild scramble has been going on at many Western points, and in the East buyers and shippers have been delayed. Hardwood is sought for at Philadelphia for South American markets, and a Minneapolis dealer shipped one million laths to Southern California. American lumber is in increasing request in foreign markets, even as far off as Australia. The effect of this increased sale will be to lead t[illegible]he opening up of new fields, and this is promised by the construction o[illegible] railroads. White-pine is selling well in a retail way in all markets. [illegible]aratively little yellow-pine has arrived yet. Hemlock is scarce. Al[illegible] hardwoods are light in stocks. Brick-makers have arranged for [illegible]creased production in the leading markets. An increased slate supply is promised from the quarries. The development of marble and granite supplies has been stimulated by the enlarging demands. Prices have not advanced, though the cost of labor has. In the building-trades the strike at Chicago has caused some unrest, as it was given out that it was to inaugurate a general strike. This is incorrect, and small building associations are helping. This year's railroad building calls for an additional one hundred thousand houses at once. The flow of men and money to these new fields balances the two great factors—industry and agriculture. Fourteen years ago the unequal balancing drew on a depression. Automatic movements, so to speak, now regulate and protect. High architectural authority in Chicago says that this years' building in the area of four Northwestern States will double last year's. The signs agree. The movement of currency prove the general correctness of the statement. Pennsylvania industrial leaders giving their latest conclusions of Southern building activity, say it is only in its infancy, and furnish figures relating to cost of manufacturing in a score of industries to prove it. The architects are busy in all cities and on a better class of work, as a rule. Each year raises the standard of excellence in house, office and mill work. Capitalists encourage the construction of more costly buildings for whatever use intended. Their operations in railroad building are more guarded because better returns are promised in other channels, which are freer from manipulations and combinations.

The inducements that will be offered during the next year or two to multiply industrial investments will be strengthened by the assured profitable character of this year's operations. The public is excusable for its suspiciousness as to the permanency of present activity, but every diagnosis discovers fresh evidence for confidence, and it will not be long before the confidence will be general and complete. It is only when we reach this point of progress that a hurtful activity, pregnant with reactionary tendencies, is to be feared.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, by TICKNOR & COMPANY, Boston, Mass. NO. 590

APRIL 16, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS.

RHODE ISLAND must be a nice place for architects to do business in, if we may judge from a letter published in *Carpentry and Building* a short time ago. The writer of this letter claims that the law in that State is such as to give architects "due protection in the submission of plans, whether in competition or otherwise." He illustrates this by describing some cases in point. In the first case, competitive designs were invited for a school-house. Several plans were sent in, one of which pleased the committee better than any of the others. The architect had submitted an estimate of the cost, but the committee, wishing to obtain further evidence on this point, requested a practical builder to make an estimate, so that they might be sure whether the house could be built within their limit, before definitely accepting the plans. The architect heard of this, and notified the committee that by laying his plans before a builder for estimate they had virtually accepted them, and must pay for them, unless he should give them special permission to get estimates of that kind. This seems to us, to say the least, rather peculiar conduct on the part of the architect. All architects who have had much to do with competitions know that this submission of the competitive plans to builders of the neighborhood, for their opinion as to the cost, usually results in the administration of a death-blow to all the designs except those of the local architects, and it is not remarkable that a competitor should wish to prevent the exposing of his plans to the attacks of jealousy and self-interest; but that any one should have had the courage, or that he should have found authority, for claiming that such submission entitled him to claim payment for his work is to us surprising. In the other case a New York lawyer, who wished to build a country house in Rhode Island, allowed two architects to submit designs, thinking that he would choose the one which pleased him best. In fact, he did so, selecting one of the plans for execution, but was astonished by receiving a bill for the design which he did not select, as well as for that which he did; and still more by being compelled to pay it. The correspondent thinks that this shows a very meritorious condition of the Rhode-Island law. He may be right, but we would not advise architects, even in Rhode Island, to count very confidently on getting paid for volunteer plans, if they should be incautious enough to make them, and we presume that the case really turned on some point not explained in the account.

A CORRESPONDENT of *La Semaine des Constructeurs* asks advice from M. Détain in regard to painting in oil over a wall plastered with cement, which he had found a rather troublesome matter. Most of us have had the same experience, and M. Détain's reply, which is the first essay on the subject which we have seen in print, has a general interest. The cause, as he says, of the spots which soon show themselves on most walls painted with oil-color over cement is to be found in the saponification of the oil by the alkali of the cement, which takes place irregularly, producing spots of lime soap. These afterwards fall into dust, and the painting crumbles away. In order to make sure that painting on cement will not change, it is necessary to destroy the causticity of the mortar before the paint is applied. This is done by washing the cemented surface with sulphuric acid, followed by clear water. After this is dry, a coat of common yellow wax, softened with spirits of turpentine, is put on, and smoothed by rubbing with a rag. The wall is then ready to receive any sort of painting, and there is no further danger of alteration. Instead of this process, the wall may be simply covered with a coat of shellac varnish before painting upon it, but the shellac is rather liable to scale off. Whether ordinary lime mortar should be treated in the same manner as cement, M. Détain does not say distinctly, but we suppose that the process would naturally be the same. It seems to be possible, however, to avoid the necessity for any subsequent treatment by employing for the coat of mortar a cement now manufactured expressly for the purpose near Marseilles, by the Société Désiré Michel, in which all free alkali is neutralized during the process of manufacture by an admixture of hydrochloric acid. This cement, when used for plastering on walls, is said not to be subject to efflorescence, and paint of any kind may be laid on it without fear of deterioration.

IN New York, a week or so ago, a shoe manufacturer was ordered by the Knights of Labor to discharge a certain man. He declined, and a large number of his employés, including a sister and a brother-in-law of the man whom he was ordered to discharge, struck. The president of the employés of the shop, who number about three hundred and fifty, refused to strike, although he belongs to the Knights of Labor, on the ground that the strike was illegally ordered; and coercion was therefore resolved upon. This was directed first against the manufacturer, whose shoes were placed under a boycott, but the manufacturer, a gentleman of spirit, having secured evidence against the Executive Board of the District Assembly, which ordered the boycott, had two of the most prominent members arrested, on the charge of conspiring to injure his business; and they will probably have a chance to learn what the law thinks of their high-handed operations. In another shoe-shop near by, carried on by a proprietor of less courage than the other, a similar interference was successfully attempted by the Union dictators. In this case a man of unusual ability and skill had the misfortune to be employed in the shop to cut out shoes. He sinned against the Order of Botchers and Idlers by cutting out a dozen more pairs of shoes a day than the Union rules allow, and was promptly fined ten dollars. He paid this fine, and kept at work. A day or two later, in a moment of forgetfulness, he again cut out too many shoes, and was fined twenty-five dollars. He tried to escape this outrageous demand by explaining that he could not help working fast, and refused to pay. This brought upon him the vengeance of the Union; his employer was ordered to discharge him, and, not daring to resist, did so, and, as a consequence, the unfortunate wretch who could not help working faster and better than the sneaks and loafers of the shop, is, for that very reason, shut out from employment, and must see his wife and children suffer cold and hunger, solely because he possesses the qualities which in any walk of life not controlled by trades' unions would secure for him and them an assured and comfortable living, and provision for sickness and old age.

THE most glaring case of tyranny now under observation is, however, that which is said to exist in Chicago, where it is beginning to attract the attention and excite the indignation of the public. According to the newspaper accounts, a watch is now systematically set upon the trade-schools which have recently been established in that city. The boys who come to the school, as many of them do, from rich families, which like to have their children instructed in some useful art, are not molested by the pickets; but if a poor boy, anxious for instruction to help him to earn a living, presents himself, he is warned off, and, if he neglects or refuses to heed the warning, is admonished by brutal chastisement that the members of the ruling class in Chicago do not propose to allow any one to earn a living but themselves.

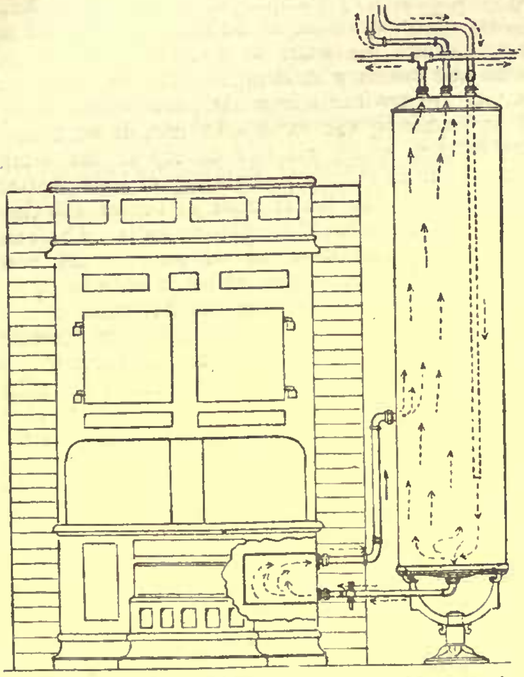
THE *Revue Industrielle* gives a description of a curious apparatus, recently employed for excavating a channel in the mud which forms the bottom in the harbor of Oakland, California. Not very far from the point at which the channel was to be excavated is a salt marsh; and as it was important not to deposit the excavated matter in any other portion of the harbor, the best method of disposing of it seemed to be to use it in filling up this salt marsh, first building dikes along the water front, to keep the half-liquid mud from washing back into the harbor. To raise the mud from the bottom of the harbor by means of dredges, transport it in boats to the salt marshes, and there unload it in the place it was intended to occupy, would be a costly operation, and it was determined to make use of a device first adopted by the Dutch engineers in excavating the North Sea Canal through sand; which consisted in pumping the material, stirred up so as to carry with it water enough to make it flow easily, through long pipes to the place of deposit. As used at Oakland, the apparatus consisted of a boat, carrying at the front a turbine wheel, enclosed in a box, open at the bottom, and communicating at the top with a pipe, about twenty inches in diameter, which led to a huge centrifugal pump, stationed on the boat, the outlet-pipe from which, also twenty inches in diameter, was continued, by means of similar pipes, with joints made at once tight and flexible by rings of India-rubber, and supported by a succession of small rafts, to the point of discharge, about half a mile away. The machinery was driven by steam from two boilers, of one hundred horse-power each. About five-eighths of the power was used for operating the centrifugal pump, while the rest was expended upon the turbine which stirred the mud into a suitable condition for pumping through the pipe. In eight months one of these machines raised and transported to the place of discharge nearly seven million cubic feet of the mixed mud and water, at a total cost, including the pay of the men who looked after the dikes, and guided the discharge-pipe, so that the mud should be evenly spread, of about a hundred dollars a day. The final cost of the excavation and disposal of the mud by this means was, however, only about ten cents a cubic yard, while similar work in the neighborhood, done by the ordinary methods, cost about thirty eents a yard.

AT one of the recent meetings of the Royal Institute of British Architects a paper was read by Mr. Simpson, on what he modestly called "Mud Architecture in Persia and Other Countries." During the Afghan disputes of 1884–85, the author was attached to the Boundary Commission, which spent so much time in trying to avert war between Russia and England, and in the course of his duties was obliged to travel from the Caspian Sea to Bala Murghab in Afghanistan, where he spent the winter, returning to the Caspian in the spring by another route. Throughout the whole of this district unburned clay is still, as it was five thousand years ago, the ordinary material for building, and to this day glazed tiles are used in Persia, as they were by the Assyrians at Khorsabad, in decorating the mud construction. Most of the clay towns, both ancient and modern, stand on artificial mounds, exactly as did the palaces of Xerxes and Darius, but, as all ruined cities of this sort gradually decay into heaps of mud, and this old and well-worked material is still much sought after for building new houses, it is quite conceivable that such mounds represent the gradual accretion of one town above the ruins of another, rather than artificial eminences raised for a definite purpose to their present height. In one instance, however, which Mr. Simpson noticed, the mound appeared to have a special character, which had either been given it originally or by a remodelling of the mass of ruins which had previously existed. This was in the village of Lasgird, about a hundred miles east of Teheran, where a circular mound, thirty feet high above the surrounding plain, carries upon its top the houses of the town. The only access to the top of the mound is through a passage so narrow that only one person can enter at a time; and the object of the whole arrangement is evidently to place the village out of reach of the Turcoman horsemen, who are incapable of besieging a place, but ravage continually in that region the towns which they find open to their forays. When kept in repair, the mud buildings are not only substantial, but often very richly ornamented. The walls are made from two to four feet in thickness, and are built in courses two or three feet high; each course being allowed to dry before the next is applied. The outside is covered with a sort of rough-cast of clay and chopped straw, to preserve it from the weather, and the rooms are finished inside with beautiful plastering, of plaster-of-Paris, ornamented with delicately run mouldings, and sometimes with raised patterns, formed by stamping the plaster while wet. So far, the process of construction is the same as that used in Southern France, where the walls of *pisé*, or clayey loam, which still forms the ordinary building material, are made in courses eighteen to twenty-four inches high, each course being neatly formed by ramming the earth into moulds or boxes, without top or bottom, which are laid on top of the work already completed; but in France a plastering of lime mortar is used for the exterior of the better class of houses, the clay covering being apparently reserved for garden walls. The best Afghan and Persian houses have, as we suppose the best French houses also have, a foundation of burnt brick and pebbles, to keep the base of the walls from the dampness of the ground, but in Persia many additional and costly refinements are used. It is quite common, for instance, in places where wood for ceiling-beams is scarce, to cover the rooms with vaults of unbaked bricks, laid with joints of plaster-of-Paris, and the interior of costly buildings is sometimes decorated, not merely with glazed tiles, but with precious stones, gold, silver, marble and alabaster. Although there is really no reason why the Persians of the present day, having the same materials to use, should not build their houses in the same way that their ancestors did, one cannot avoid a certain sense of amazement at the awful antiquity of this particular custom. Perhaps the most startling objects that archæology has ever brought to light are the alabaster slabs, sculptured with colossal bulls with men's heads, and processions of genii and giants, which, five thousand years ago, lined the lower part of the mud walls of the king's palaces in that very country where the descendants of the richest and most luxurious people that the world has seen, now, harassed by troops of little horsemen with sheepskin caps, shut themselves up in villages of huts, which they build exactly as their forefathers did, out of the same old materials, ornamented, in many cases, with tiles which were baked for the same use, perhaps by the potters who supplied Nimrod with mural decorations. Independent of sentiment, there is a good deal to be said in favor of a material essentially so indestructible as this, and we are not without hope of seeing it used in the Mississippi Valley and other places where wood, stone and burnt brick are hard to get, but loam, such as is used for *pisé* near Lyons, is abundant. It is quite possible that the unbaked walls would be unable to resist the frosts of the region north of Saint-Louis, but neither Lyons, nor the portions of England where similar walls are often used, have a milder climate than Mississippi or Louisiana.

THE *Sanitary Engineer* makes some interesting comments on the annual report of the Registrar-General of England, which has just appeared. As might be supposed, in view of the efforts which are now being made in every part of England to secure pure air and water, with the other most important conditions of healthful life, the death-rate has diminished; the proportion last year having been nineteen per thousand, the lowest yet recorded, with the exception of that of 1881, which was eighteen and nine-tenths per thousand. As sanitarians know, the effect of improved external conditions shows itself first in the decrease of mortality among children, and in 1885, out of every thousand children born during the year, only one hundred and thirty-eight died, the average proportion for the ten preceding years having been one hundred and forty-four. The birth-rate, singularly enough, has diminished with the death-rate, the rate for 1885 having been only thirty-two and five-tenths, the lowest for forty years. Something of this is undoubtedly due to the decrease in the number of marriages which always accompanies material prosperity and comfort, but it is also to be considered that, by the diminution of the death-rate among children, the proportion of young persons in a given population is increased, and the people of marriageable age bear a smaller ratio to the whole in consequence. It is evident that if the whole population is renewed every fifty years, a comparatively slight change in the character of the annual additions to it will soon modify the general complexion very materially, and it seems as if the civilized world were slowly tending to become more youthful, as well as more healthful in constitution. It would be easy to speculate at some length on the changes in the moral and æsthetic, as well as the physical results which might follow in the course of centuries from this tendency, but every person can do that for himself.

THE WATER-SUPPLY OF BUILDINGS.[1]—IV.

HOT-WATER CIRCULATION.



The black lines in Figure 5 represent the hot-water circulation-pipes, and the initial cut gives the detail of the range-boiler and hot-water back. The boiler is fed with cold-water through a branch from the falling main as shown, which enters through the domed top of the boiler, and descends on the inside to within a short distance of the bottom, as indicated by the dotted lines. The cold-water being heavier than warm, is always found at the bottom of the boiler. Hence a pipe opening out of the lowest part of this bottom, and connecting with the under side of the water-back will receive the cold-water, and conduct it to the water-back to be heated. The water-back should, as Mr. Gerhard rightly says in his "*Domestic Sanitary Appliances*" properly be called the boiler, "for it is the vessel in which the water is heated, while the so-called 'boiler' is simply intended as a means of storing hot-water until it is drawn off at the plumbing fixtures." As the cold-water becomes heated in the water-back by the range fire, it rises to the top as indicated by the arrows in the initial cut, and a pipe opening out of its highest part will receive the heated water, and conduct it back to the upper part of the boiler. The pipe enters the boiler at a point above the lower end of the cold-water supply-pipe, and usually about a third up from the bottom of the boiler. The heated water rises thence to the top, as shown by the arrows. Again, a pipe opening from the top of the boiler will receive this heated water, and conduct it to the various hot-water faucets throughout the house. Thus we have, on one hand, a column of cold-water descending from the main house-tank to the bottom of the boiler, and on the other, a column of hot-water ascending to the highest faucet. To create a good and constant circulation in these columns would require them to be connected at the upper end as well as at the lower; but as it is not desirable that the falling main should form a hot-water conduit, a special down-pipe, called the "circulation-pipe" should be provided. This is connected with the rising hot-water-pipe at a point above the highest fixture, to which the hot-water is supplied, and descends to and connects with the bottom of the boiler as shown in Figure 5.

The rapidity of circulation depends upon the difference of temperature between the water in the ascending hot-water-pipe, and that in the descending or circulation-pipe, and this difference again upon the rapidity with which the heat radiates from the pipes, and is restored again to the ascending-pipe by the range fire.

The advantages of this return or circulation-pipe are, first, that it enables hot-water to be drawn at once anywhere on the line of the circulation without requiring any water to run to waste; and, second, that it maintains a more uniform temperature in the boiler, and thus relieves it from undue pressure; for, if the circulation were limited to the water in the boiler, and fire-back themselves, as would be the case were there no circulation-pipe, nearly all the heat generated in the water-back would be confined to the water in the boiler instead of being distributed throughout the house.

There would then be the danger that the temperature of the water in the boiler would be elevated so high as to permit of the generation of steam therein, and in such case the sudden drawing off through the faucets of water from the boiler would be followed by a correspondingly sudden influx of cold-water, which would condense the steam, and, creating a vacuum, would be liable to cause the collapse of the boiler where no special inlet-pipe were provided to prevent this accident.

Where a circulation-pipe is used, the rapidity of circulation

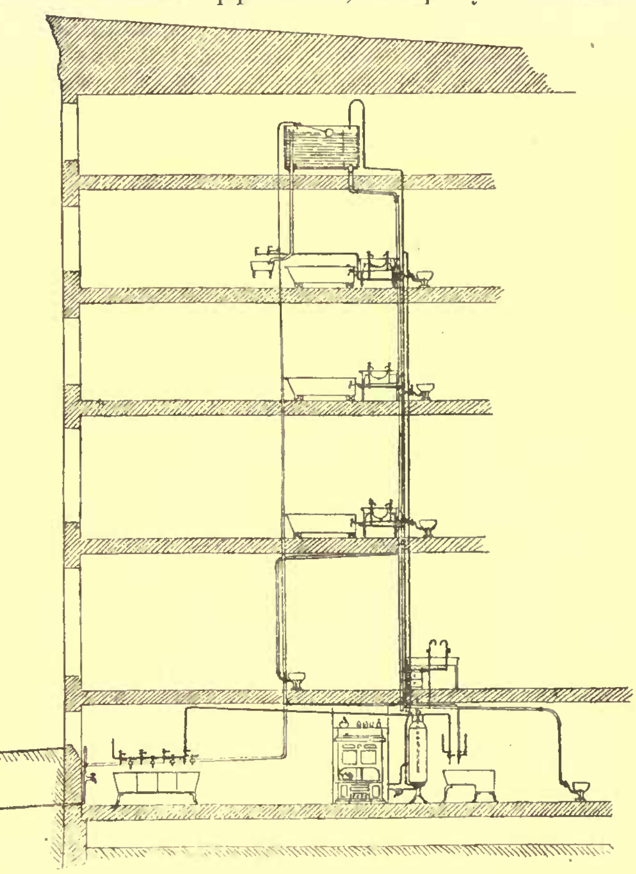


Fig. 5.

is increased in proportion to the increase of temperature of the water in the boiler, and thus the loss of heat by radiation from the entire surface of the hot-water-pipe system tends to keep the temperature of the boiler below the steam point.

It is in the hot-water arrangements that we find one of the great advantages of the tank over the direct-supply system. Under the constant heavy pressure of the latter, the boiler is more liable to leak and even burst, owing to the heavy shock of water-hammer, caused by the sudden closing of cocks.

It is always desirable in the hot-water arrangements to provide a steam-escape or relief-pipe. This is simply an extension of the hot-water rising main to a point as much above the water-level in the tank as is required to enable the hot-water column to balance the descending cold-water column, and to render it secure against overflowing into the tank.

Its end is bent over into the tank and remains open for the escape of steam. Mr. Gerhard explains the double purpose of this expansion-pipe as follows: "In the first place, it renders the boiler safe against explosion, as any surplus of steam generated in the water-back can readily escape at the open end of the relief-pipe. Secondly, it efficiently prevents the collapsing of a boiler, as it would serve to admit air to the boiler in case the water is drawn out. It is usual to make the steam-escape pipe of a small diameter, but I much prefer to retain for it the full diameter of the hot-water rising main. This increases the expense a trifle, but it also adds to the security of the boiler."

Figure 5 shows the relief-pipe rising above and bending over into the tank. Evidently where no main tank is used, there can be no relief-pipe, for the pressure from the mains is calculated to be sufficient to carry water to the tops of the highest houses, and is subject to constant fluctuation and alteration. It would, therefore, rarely be possible to carry the relief-pipe above the point to which the water might rise under any possible condition of head or pressure, and to provide both for the present and for the future condition of the public water-supply.

Although a constant circulation is kept up within the boiler so long as the water is heated by the range fire, the movement is nevertheless not sufficient to prevent the gradual deposit of a great deal of sediment upon its bottom and sides. To remove this as far as possible, a sediment-cock should be furnished at

[1] Continued from page 124, No. 585.

the lowest part of the pipe leading from the bottom of the boiler to the water-back, to which a hose may be attached, to blow off or empty the boiler. This sediment-cock is sometimes connected with the waste-pipe or trap of the nearest fixture, but this practice is to be condemned, on the general principle that no water-pipe should ever have direct connection with any waste-pipe.

The incrustation of dirty deposit in boilers will increase in time to a greater or less extent, according to the degree of impurity of the water-supply, in spite of a periodical blowing-off of the contents of the boiler. As a rule, therefore, water drawn from the kitchen boilers should not be used for drinking or cooking purposes, and to prevent this, as well as to ensure against outsiders tampering with the cock, it is best to so construct the latter that it can be operated only by means of a wrench, to be kept in the custody of the house-owner.

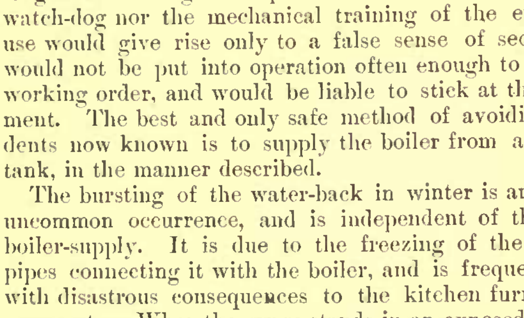
The size of the water-back and of the boiler should be properly proportioned to each other and to the size of the house or consumption of hot water. A disagreeable rumbling noise is frequently caused in the kitchen boiler, when, under the direct-supply system, the water-back is too large for the boiler, due to the generation of steam.

As precautions against the bursting and collapsing of boilers supplied directly from the street, many kinds of safety-valves have been devised for letting off steam generated in the water-back, or for admitting air into the boiler to supply a partial vacuum therein. If we could be certain that such safety-valves on kitchen boilers would always be looked after as carefully as they are on steam-boilers under the supervision of an expert engineer, we might feel a certain security in their use, but, so long as the average cook possesses neither the alertness of the watch-dog nor the mechanical training of the engineer, their use would give rise only to a false sense of security. They would not be put into operation often enough to keep them in working order, and would be liable to stick at the critical moment. The best and only safe method of avoiding these accidents now known is to supply the boiler from a main house-tank, in the manner described.

The bursting of the water-back in winter is an event of no uncommon occurrence, and is independent of the method of boiler-supply. It is due to the freezing of the water in the pipes connecting it with the boiler, and is frequently attended with disastrous consequences to the kitchen furniture and its occupants. When the range stands in an exposed position, and its fire is allowed to go out, say at night, in very cold weather, there is danger of the water freezing in the connecting-pipes. In the morning, if the range fire be lighted without first examining into the condition of these pipes, the water in the water-back, deprived of its ordinary exit for expansion and circulation, is obliged to force another by shattering the water-back itself. To provide against serious disaster from this cause, a portion of the water-back should be constructed of a soft metal, properly arranged to secure it against direct contact with the fire, which would yield to the pressure of the steam before it accumulated to a dangerous extent. J. P. PUTNAM.

[To be continued.]

THE COLUMN AND ITS THEORY.



P. WHATEVER may be the future development of architecture, though it may even assume forms which shall be not only repudiated by any of the styles and variety of styles that have hitherto attained to classical rank whether in the East or West, but shall be fully entitled to claim admission to such rank in virtue of the proper merit and originality, still I believe the column will hold its place as one of the chief architectural glories. If it finds place and employment in any such presumably possible novel styles, it will assert a governing influence, and if it is excluded from them, it will assuredly secure the survival along with them of those styles, of which it is already an accepted element and ornament. Thus at least, I am content to express my conviction of the power, might and majesty of this noble architectural member.

Q. Do I understand that you mean specifically the column as we know it in Greek architecture, and in those variations which affiliate on the Greek, in Roman and Renaissance work?

P. Even so; but with more rigid reference even to the Greek types, and to those later forms which indicate most consciousness on the part of the designers, of the principles which at once promoted and regulated the inventive genius of the Greek.

Q. But how are we to arrive at these principles? It has long been admitted that they are not to be found in Vitruvius, whose rules will not apply to a single Greek building, and the treatises of the Greek architects are lost.

P. But not the working drawings of their buildings and the illustrations of their books. What else but the equivalent of such illustrations and drawings, are the engravings in which modern architects have embodied such treasures of accurately-measured plans and elevations of so many of the finest Hellenic temples? These stores supply us with details of columns of a succession of centuries, as well as of different styles, and from different localities; we ought to be, and I will say that we are, thus enabled to trace how the perfection of theory, and perfection of design were attained concurrently.

Q. But is the column to be studied independently? Important as it is, it is but one member of the order; its functions and proprieties are relative to an entablature.

P. Very true; and relative also to associated columns, as it is spaced more or less widely; for one height of a column will be appropriate when a certain interval is adopted, but cease to be so if the array is opened out or closed up immoderately. But the larger questions may be postponed. There is quite enough to occupy us at present in analyzing the design of the Greek column regarded as a constituted if subordinate whole, possessed of a unity in itself, however that unity may have been adopted from considerations that for the time are extraneous to our inquiry.

Q. What have you to say of the column which is shown in relief over the gateway at Mycenæ, between the lions which so oddly have the air of heraldic supporters?

P. Contrasted as it is with later examples it has a distinct title to stand at the head of the historic series of Hellenic columns. This title is established by the mouldings of the capital, which strange to say, are precisely those — reversed — of the later Attic base of an Ionic column, a larger and a smaller torus, divided by a scotia.

There is then the further anomaly that the shaft diminishes from above downwards. There is every appearance from certain fragments, that the engaged columns which originally decorated the entrance to the so-called Treasury of Atreus, were similar in design; and it is to be supposed that both followed the type which was familiar in the more stately of the buildings contemporary with these tombs and the gateway.

Q. But how do you account for so strange an inversion of naturally suggested order, as making the column —the supporting prop — diminish downwards?

Q. I cannot pretend to account for it; some have suggested that the original model was the trunk of a palm tree which increases somewhat in diameter upwards; some that the column copies trunks of trees that in primitive construction were made pointed downwards, to be driven into the earth. There however, it is, and he was a wise workman who broke loose from precedent, and turned the traditional column of his predecessors upside down. Changes of this kind are sometimes made in a violent attempt to get novelty at any cost; much as some talkers assert originality by reckless contradiction, or as fashion exhausting itself in one extreme, flies to another. So did the Jacobean architects obtain a sensation of novelty, if not a novel sense of beauty, by renewing the Hellenic norm of a column, and going back unconsciously to the barbaric Mycenæan norm of a column, having its least diameter at the base. Greek art furnishes us with a parallel in vase painting to their happy reversion of the column. The archaic vases were decorated by painting black figures on the red ground of the material of the vase. This system was long persevered in, and lasted till design and draughtsmanship had made very admirable progress. Then the revulsion seems to have been sudden and complete, and the advantage was seen of painting the entire ground black, and leaving the ruddy material relieved by interior lines, to present the nude of the groups. This alteration once adopted was pursued in its turn, till all its resources of beauty and effect had been successfully brought out.

Whether the transition from the model of the Mycenæ column was sudden or gradual cannot be told; as absolute a gap occurs here in monumental, as so perplexingly isolates the Homeric poems in poetical, history. The only difference is that in the latter case it is the most perfect work that stands alone, like a blazing beacon, of which the remoteness cannot be estimated, because no intermediate object is visible in the pitch-dark night.

Q. I have spoken with no kindness of Vitruvius, and yet I confess I have always been taken by his notion that there is a very masculine character about the Doric column, and a feminine about the Ionic; nay, that he is not quite absurd in pressing the analogy so far as to associate the volutes with the curls and the flutes of the Ionic columns with the deep, vertical folds of a maiden's garment; and with respect to Doric, in connecting the average six diameters given to its height with the height of a man in terms of the sole of his foot.

P. I will give in to the impression so far as to affirm that the general associations which we have with the erect human figure, cannot but blend insensibly with those suggested independently by the vertical column. But other associations equally recurrent and equally

vague are furnished by familiar parallels with the vegetable world, — with the trunks and stalks of plants, and their lessening upward to be crowned by an expanding, capital-like flower. Otherwise the expressiveness of all artistic compositions varies between the poles of severity on the one hand and delicacy on the other, and approaches or diverges from what is felt to be a masculine type accordingly. But let us come to particulars.

The uppermost member of the Doric capital, the flat, square, tile-like block or abacus, gives satisfactory suggestion of the pressure of the architrave being equally distributed, and also of furnishing a bed for the soffit which exceeds the upper diameter of the column. This flat member is the most distinct expression of the flat proportion of the capital, which, as less high than broad, prepares a transition to the horizontal members above; the curve of the echinus, the intermediate saucer-like member, reduces the harshness of the transition. It reduces it, but still in the finest examples has itself a leaning to severity. In the archaic column its swell is very pronounced; in the Parthenon this is reduced to the utmost, and the profile is as nearly straight and upright as it can be, to remain a curve. The excessive horizontal projection is thus reduced, and the abacus projected on plan only moderately exceeds the lower diameter of the shaft.

Q. But why is the Doric column destitute of a base?

P. The explanation will be given if we inquire why do we not seem to miss and require a base? I should say because the rapid spread of the column downwards gives it manifest firm foothold; and then because it is the characteristic of the style to dispense, as far as possible, with such transitional curves; whereas, the architect of the Ionic style as consistently multiplied them, for sake of softness.

We have no very archaic examples of Doric columns from monuments in Attica, where the style was brought to perfection, and we must resort for comparisons to those of the neighboring island of Ægina, and to the very ancient remains at Corinth. At both Corinth and Ægina, the height of the abacus, contrary to later practice, is less than that of the echinus; then the differences between the upper and lower diameters and the spread of the abacus are more exaggerated; that is, the diminution of the column upward was quicker than later architects approved, and so, also, was the expansion of the capital upward. In the two temples at Ægina and Corinth, the column was short relatively to its lower diameter; they were of sturdy as contrasted with tall proportions. But certain intimations might be cited that this heaviness was not a universal characteristic of archaic Doric, and no sign of mere primitive clumsiness, but a variation from lighter types, and deliberately insisted on as conducive to solemnity and dignity.

It is evident that the beauty or dignity of the column will depend mainly on its proportions, however these may be determined on. Taste and imagination must here, no doubt, be the arbiters in the first instance, but they can only help us to the "there or thereabouts." When ponderous masses have to be dealt with, the exact measurements, whether prescribed by graduated rule or template, become necessities. Doubtless the ancient architect, like the modern, in scanning the work of a predecessor, was keen to note on what his best efforts depended, and no less on what depended his failures to produce the best effects within his reach, and took the lessons so derived to heart. The ancient artist, moreover, was familiar above all things with the idea that great was the virtue of precise numerical proportion. He lived in an atmosphere of theories upon this subject. It was not only that the genius of the Greeks seems naturally sensitive to symmetry in combination with such complexity as their lyrical poetry displays, but speculation was active in pressing to its uttermost legitimate application, and even beyond them, the principles attached to the name of Pythagoras, and ever insisted on by a school named after him. The grand discovery of the dependence of musical harmony on definite physical proportions was held to be, as it was, in fact, but a glimpse of the dependence of all beauty and all effective concerted operation both in nature and in art, on definite proportions. The proof is clear, in the case of the Parthenon, that it was in absolute subjection to this conviction that Ictinus worked, when he regulated the proportion of every part, small and great, with such marvellous exactness, by a definite scale. In these columns of earlier date, we can discern that the same feeling was predominant; but the effect brought out by the best instrument depends, at last, on the skill and taste of the performer.

The upper and lower diameters of the shaft and that of the echinus of the column at Corinth are in arithmetical progression as 3, 4 and 5; thus: —

$$4.342 \div 3 = 1.447$$
$$5.853 \div 4 = 1.463$$
$$7.304 \div 5 = 1.460.$$

The height of the column exceeds four lower diameters by about four inches.

The same arithmetical progression, 3, 4, 5, obtains in the Doric column of the temple by the port at Ægina; but in this instance the quickness of diminution is relieved by the relative tallness of the column, which here measures six lower diameters in height.

The column of the so-called Temple of Jupiter at Ægina has its diameters regulated by the same proportions; it is more slender than that at Corinth, being about five and one-third diameters in height, and less so than its fellow by the port. It further agrees with that at Corinth by absence of precise commensurability between height and diameter.

I am inclined to think, however, that the architect may have satisfied himself by the height of the column to the top of the echinus measuring exactly five diameters, as seen from the front — that is, as taken across the chord of opposite flutes. This comparison comes out with great exactness, whether we ascribe any artistic value to the adjustment or not.

When we cross the waters of the Saronic gulf into Attica, we find that the architects there had quite as strong a conviction of the value of precise proportions, but renounced the curb of strict arithmetical progressions. Every stone of the beautiful little temple of Artemis Propylæa, at Eleusis, has now disappeared, but its details have been happily preserved by the Society of Dilettanti. The temple of Theseus still remains in marvellous preservation.

In the Theseum, the excessive quickness of diminution is corrected; the proportion between upper and lower diameters of the column is 7 : 9, a degree nearer to equality than the 3 : 4 (= 6 : 8) of Ægina; the lower diameter has the proportion to the abacus of the eastern front, as 9 : 10. We have, therefore, the sequence of magnitudes, 7 : 9 : 10 replacing the archaic 3 : 4 : 5.

A relation between horizontal diameters and the height of the column is obtained, in this instance, by that height being exactly equal to the breadth of the abacus × 5.

In the little temple of Artemis, at Eleusis, the diminution is further reduced; the proportion of the upper to the lower diameter of the column is here 4 : 5 (= 8 : 10). We have, therefore, in these three examples, a progressive series — 6 : 8; — 7 : 9; — 8 : 10.

The proportion of the lower diameter to the abacus is 7 : 8; a considerable approach to equality, as compared with the Æginetan 3 : 5 (= 6 : 10), and slightly less than that of 9 : 10 in the Theseum.

In the Eleusinian column the height is six times its mean diameter. Such are a few examples of the appreciation by the Greek architects of the value of exact proportional dimensions, and of the principles on which they relied for producing unity of effect and novelty also in their untiring pursuit of dignity and grace.

Q. And yet there is something that I still am in want of?

P. The application of such principles, perhaps, to Ionic architecture? The little temple on the Ilyssus may serve; the three dimensions there are proportioned with great exactness as 6 : 7; and 8.

Q. What I had in my mind was to ask, in conclusion — for our time has nearly run out, — for a brief statement of the scheme of columnar proportion applied in the masterwork of Greek architectural genius, the Parthenon.

P. I will do my best to satisfy you — and myself, for I must own that in looking up the result of my analysis made some years since, I have a lively recollection that it cost me more trouble than all the others put together.

There is difficulty in obtaining the measurements which are the indispensable basis for any such comparisons. Stuart is not to be relied on here. The dimension which he gives for the lower diameter is too erroneous for us to trust him for the upper, and it is the upper diameter of the column which is particularly required. By deductions which are extraneous to our present discussion, the height of the column, the dimension of the abacus and the lower diameter are fixed independently, and the question remains what diminution will harmonize all these foregone determinations. Here even Penrose vexatiously disappoints us. We are left to deduce an upper diameter for an ordinary column from a plate which is designed only to illustrate entasis. But the columns vary manifestly on some principle which could be best, and indeed could only, be explained if we were assisted to discover by exact measurements of the chief varieties which constituted the norm. In what comparisons we are able to make, there is a surprising absence of simple proportions, such as we have been noticing, and we are left to search for some more recondite processes.

I have come to this conclusion — the sixth of the given height of the column is the mean diameter of the stouter angle column, and as the lower diameter is also given, the upper is deducible. Height $34.25 \div 6 = 5.708$ (mean diameter) $\times\ 2 = 11{,}416 - 6{,}332$ given lower diameter $= 5{,}034$ upper diameter.

The proportionate dimensions thus obtained for the angle column are verified by exact application to the ordinary column: —

6.38 : 5.03 :: 6.245 lower diameter of ordinary column : 4.92.

This dimension 4.92 agrees with the upper diameter of the ordinary column, as it appears to be obtainable from Penrose's Plate XIV.

Now I think you will be glad to dismiss me, and it would be well you should do so, for much more might be said on the subject.

W. WATKISS LLOYD.

MANGANESE STEEL. — The difficulty experienced in producing manganese steel of a perfectly homogeneous character and of an invariably uniform quality seems to have been overcome by Pfeil & Co., who, after long trying to do so, have apparently succeeded in accurately proportioning the ingredients so that the above results are attained, in their "retort manganese steel," as it is called. We recently witnessed some remarkable results at their stores, Clerkenwell, London, with bolts and nuts made from this metal. Bolts were bent over by hammering through about 120 degrees in the threaded part without showing the least sign of distress, and nuts were hammered down until the screwed way was nearly closed, with similar results. The same test was applied to the necks of the bolts, which were only broken through by being hammered back again, the metal showing an excellent fracture. Bolts and nuts of this steel have been severely tested by the Government, with the result that they are now being used in the royal dock-yards and in the carriage department at the Royal Arsenal, Woolwich. — *London Times.*

THE MANUFACTURE OF WHITE LEAD IN BELGIUM.



CONSUL GEORGE D. ROBERTSON reports to the State Department that this industry, which, so far as any recent times are concerned, is said to have been "born" in Holland, was introduced into Belgium from the former country about the year 1815, or at the time of the annexation of Belgium to Holland. The industry increased quite rapidly, relatively speaking, of course, so that in 1830, when this branch of manufacture was still but little known in France, there were three or four such works in Belgium. As to their importance or capacity, however, it is impossible to give any data.

It is an error to suppose that the discovery of this substance is even of comparatively recent date, for the artificial carbonate of lead was known to the Greeks and Romans. The ancients obtained it by means of the action of vinegar on lead exposed to the air. The Dutch were the first to take up, follow out, and improve on the methods of the ancients. Nowadays it is known as the Dutch process, and is to this day the one most generally employed, and the one which gives the best results, and the most superior quality for the product. Besides the Dutch method, however, there are the German, French and English. Taking them in order, we will first consider the Dutch, and give a description of the processes employed:

Double-refined lead of the best quality, and absolutely free from all foreign substances, such as iron, copper, zinc., etc., is run into plates or strips about two feet long by four-and-three-fourths inches wide. These strips are then twisted into spirals, and placed vertically into small earthen pots, made in such a manner as to prevent the strips reaching or touching the bottom. Into each pot is poured a certain quantity of vinegar. They are then placed in superposed layers, between beds or layers of manure and tan-bark, in such a manner as to form parallel heaps thirteen to sixteen feet long, and nineteen to twenty-two feet high. Often these heaps are sunk into the ground to the depth of a metre (40 inches). Three sides of this heap are protected or maintained by solid walls of masonry, while the fourth is left open for the charging and discharging. First, a layer of manure, having already served, is placed on the bottom to the depth of about one foot. Upon this are placed the pots nearly full of vinegar; they are then covered with sheets of lead, and over these are placed thick planks of wood. On these planks is then placed a layer of fresh manure. For this layer *only* horse manure is used; it has a thickness or depth of about sixteen inches. On this is placed another series of pots, and so on until the pile has the required height or number. Each layer or section consists of from 1,000 to 1,200 pots, and between the pots and the side walls or masonry, a layer of about a foot of manure is placed. A number of little holes or chimneys are made or left in the heap, to insure a free circulation of air. This latter point is a very important one.

The operation is completed in from four to six weeks, for one must not lose sight of the fact that under the influence of the fermentation of the manure caloric is formed, which provokes the volatilization of acetic acid, and of this acid the third necessary agent is oxygen.

The beds or heaps are now uncovered, and the lead, in great part carbonized, is taken out to be submitted to manipulation, the object of which is to detach, wash, grind, and dry the "*céruse*," or white lead.

Nowadays the greater part of these operations is performed mechanically in vast sheds, well ventilated, but in spite of this, from a hygienic point of view, all these operations are more or less dangerous, for which, however, the carelessness and heedlessness of the workmen are said to be largely to blame.

The men should never work except in a blouse, used only for this purpose; the face, or at least the respiratory organs, should be protected by a wet sponge. When meal-time comes, they should take off their blouses, and carefully wash the hands, head and face. With these simple precautions, they would avoid absorbing with their food the fine particles, which could easily fall into it from their clothes, hair, etc. A little iodine of potassium each week, and the frequent usage of milk and eggs are the best palliatives against this dangerous work.

In the German method, lead perfectly pure is run into strips, bent double in the middle, and suspended on slats in cases or chambers in such a manner that their edges do not touch each other or the sides of the chamber. In this chamber is a mixture of vinegar, or grape-juice, or mesh, artificially heated. The temperature is regulated as follows: the first week 76°, the second week 100°, the third week 114°, and the fourth week 124° Fahrenheit. The heat volatilizes the acetic acid at the same time that the fermentation of the liquor develops the carbonic acid.

This process has enjoyed a great reputation in Austria for the extraordinary beauty and whiteness of the *céruse* resulting from it, which was called "*blanc de Krems.*" To-day in Germany all the white lead is made without the use of manure, but the carbonic acid is obtained by the combustion of coke or chalk. The upper part of the chamber is furnished with a chimney, so constructed as to draw the carbonic and acetic acid under the sheets of lead. There are some of these chambers which work as high as 30,000 kilos of lead at one time. The white lead obtained in this manner is, however, considered to be very inferior to that made by the Dutch method.

The French method is also very old, having been known at least as early as the year 1809. It is said to be little, if any, employed, however, except in the works in Clichy, near Paris. It consists in dissolving litharge in acetic acid, in order to obtain a solution of acetate of lead or extract of saturn. In causing to pass through this solution a current of carbonic-acid gas there ensues a formation of *céruse* (white lead), and at the same time acetic acid is set free. This latter reacts on the litharge, and transforms it into new quantities of acetate of lead; these are decomposed in their turn by the carbonic-acid gas, and this is continued until the complete transformation of the litharge into white lead. This is washed, dried and packed like the Dutch product.

By the English method the lead is melted in vessels, from which it runs on to the bottom of a reverberatory furnace, which continually receives a current of air from a bellows; the lead spreads and divides itself, thus offering a large surface to the air, and runs into a trench, the side walls of which are pierced by small holes, through which the litharge passes.

This litharge, finely pulverized, is wet with a solution, in water, of one per cent of its (the litharge) weight of acetate of lead, and introduced into wooden vessels, closed outwardly but communicating between each other. Burning coke in a reverberatory furnace, a current of impure carbonic-acid gas is made to pass through the litharge. The bellows, already mentioned, suffices to force the current of gas clear to the litharge. Rakes run by steam continually agitate the oxide, which favors the combination with the carbonic acid.

There are no reliable data available as to the exact amount produced in the early part of this century, but it is safe to assert that this production was very limited.

The present annual production is given as follows:

	Tons.
Belgium	4,000
France	8,000
Germany	7,000
England	4,000
Holland	7,000
Total	30,000

The principal consumers are the United States, India, Italy, Greece, Spain and Mexico; but I am unable to obtain the figures.

England is said to import large quantities of French and German white lead, which she treats with her own product before selling.

Belgium exports about 1,000 tons per annum to France, but very little to other countries, Holland and Germany having practically the monopoly for the direct exportations.

In former times the manufacturers of white lead were in the habit of selling their product in the form of a very dry powder, each large consumer mixing it with oil as required. Now, however, it is sold in the proportion of about two-thirds powder, and one-third in cakes already mixed with oil. This large proportion in the powdered form is explained by the fact that France, which is Belgium's principal customer, admits the "*céruse*" in a powdered form free of duty, whereas mixed with oil it pays a duty of 4 francs per 100 kilos (80 cents per 200 pounds). In addition, those who wish to add to their profits by mixing the white lead with sulphate, of course buy it in its powdered form.

France and Holland furnish most of their white lead in the form of cakes already mixed with oil, this mixing being done mechanically, and in very large quantities. This is a great boon to the painters, the grinding by hand being very unhealthy and dangerous.

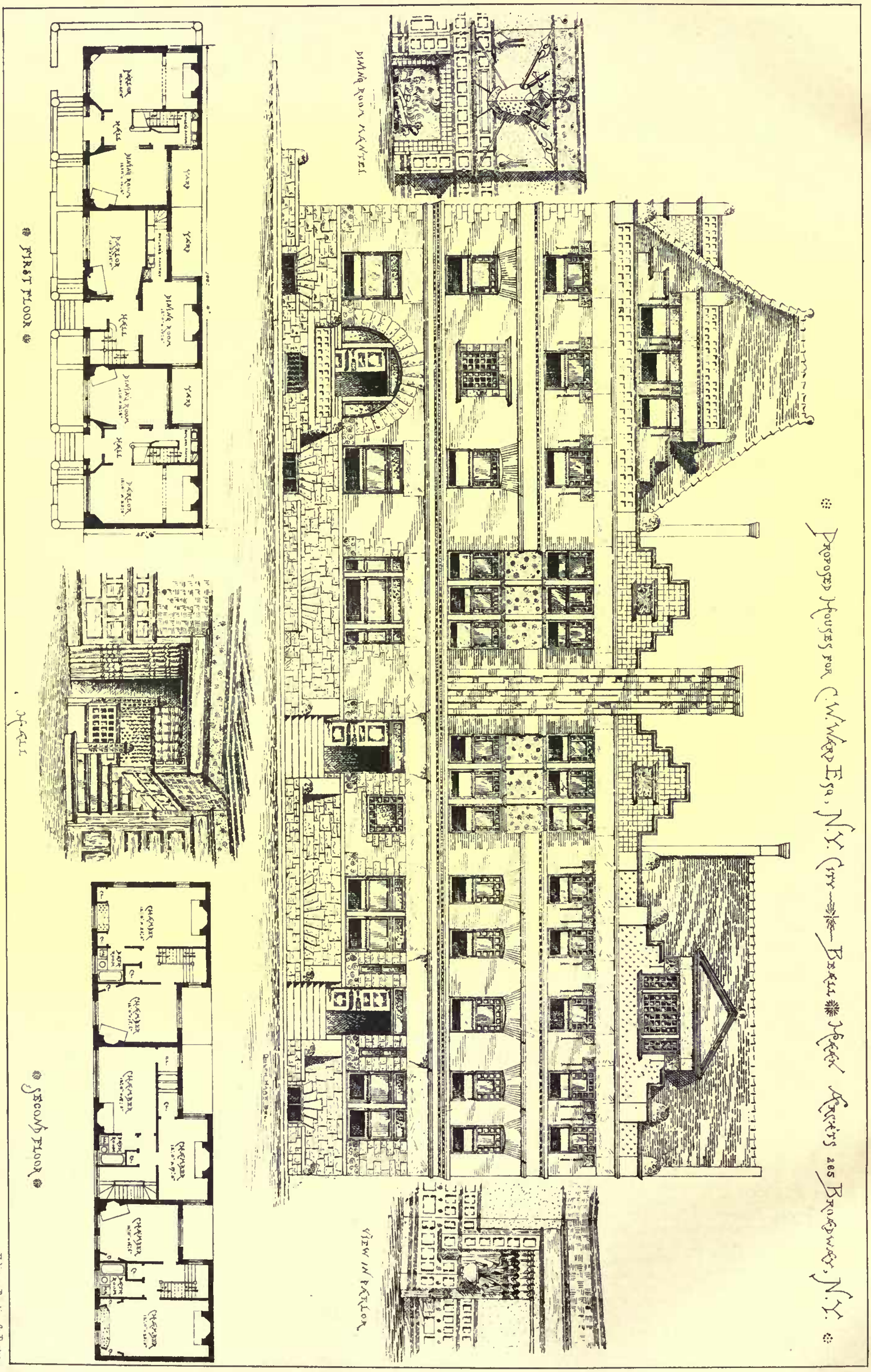
The names by which white lead has been known have been pretty much the same from the earliest times. It has been called "*blanc de plomb*," "*carbonate de plomb*," "*céruse*," "*blanc d'argent*." "*blanc de Holland*," etc. To-day it is known in this market by the one name, viz., "*céruse*."

For a long time Belgium furnished her own lead ore, but her lead mines are now all exhausted, and are either closed altogether, and abandoned, or produce zinc only. (Her production of zinc ore is also practically at an end. See my report on zinc ores, Consular Reports, No. 69, October 1886, p. 194). There is now, I am told, only one lead-smelting work in Belgium, and this one obtains its lead ores from Algeria, Spain, France and Sardinia.

France still produces some lead ore, and in the Rhine provinces of Germany there are several lead mines and foundries. Belgium buys her lead of these latter works, and pays, or did pay at the end of 1886, 34 francs ($6.80) per 100 kilos (200 pounds). During the last five years the price of this mineral has fluctuated between 28 and 32 francs. For 1887, it is offered at 34 francs, but I am informed that this price will not be accepted.

The lead from which white lead is to be made must be of the first quality, double refined, and absolutely free from all foreign substances, such as iron, copper, zinc, or antimony, which, if present, would impart a grayish or yellowish shade to the white lead. Lead from silver ore containing lead would be as good as any other, but

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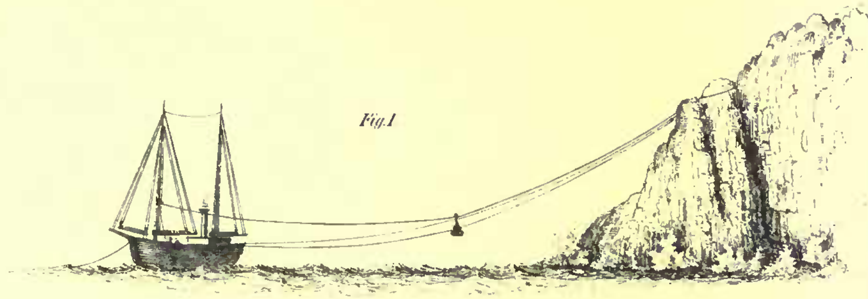


Heliotype Printing Co. Boston

FIRST ORDER L.H., TILLAMOOK ROCK, OREGON.



Elevation (South Side), showing the Rock as it appeared originally


Fig. 1

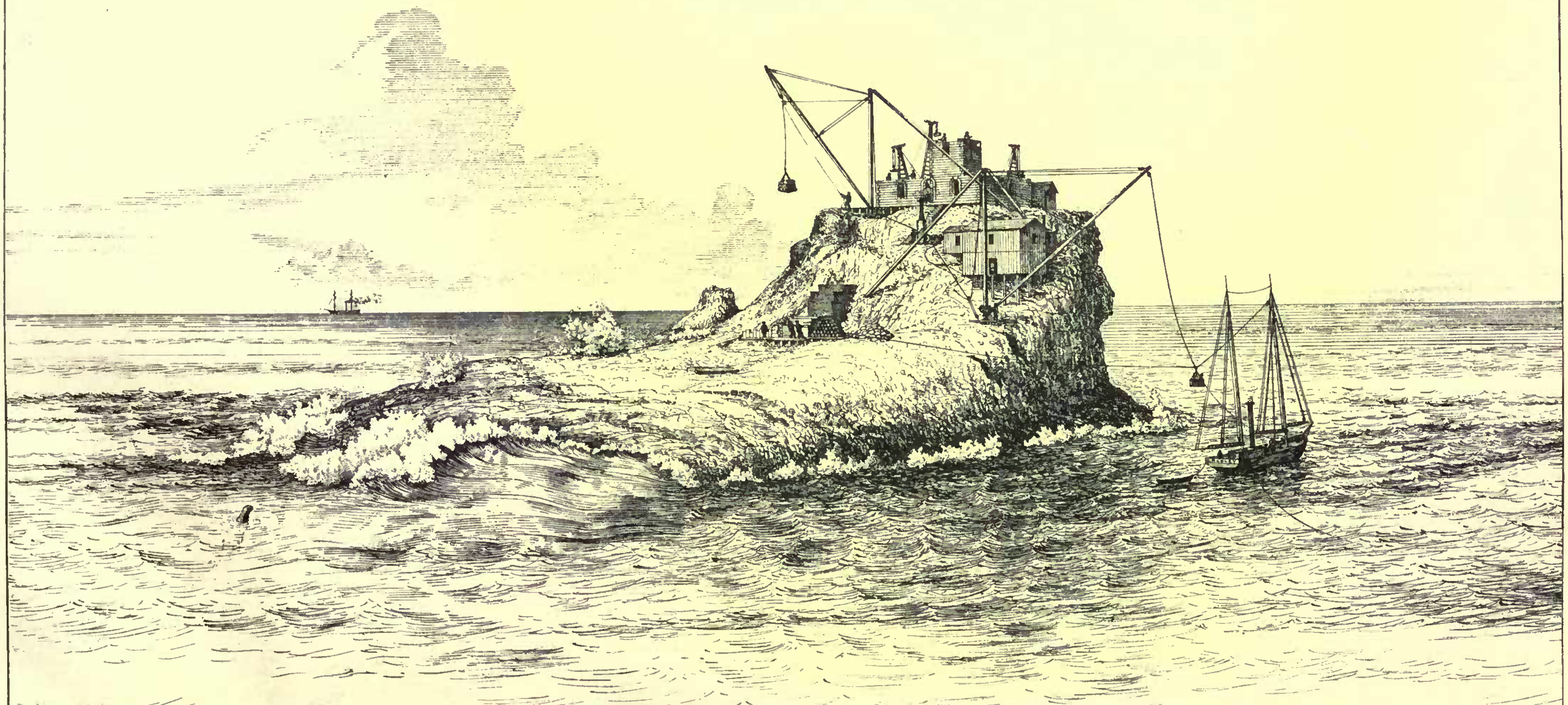
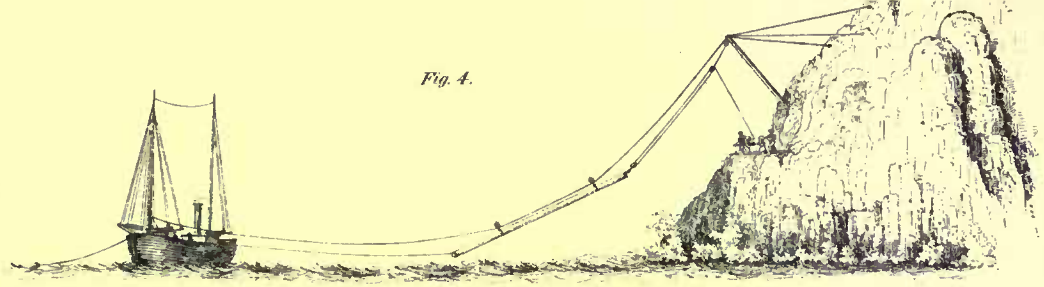
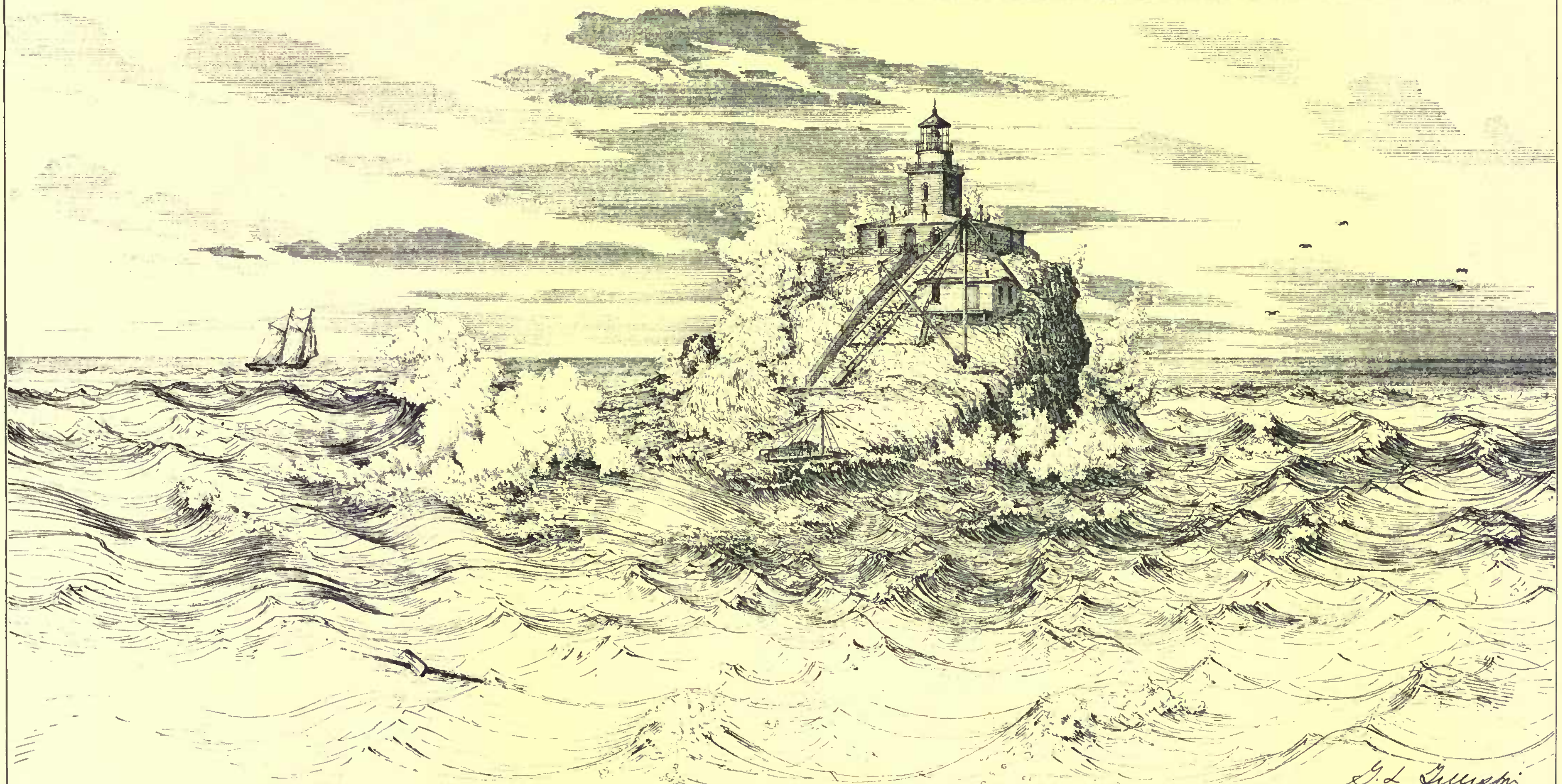


Fig. 2.



Fig. 4.



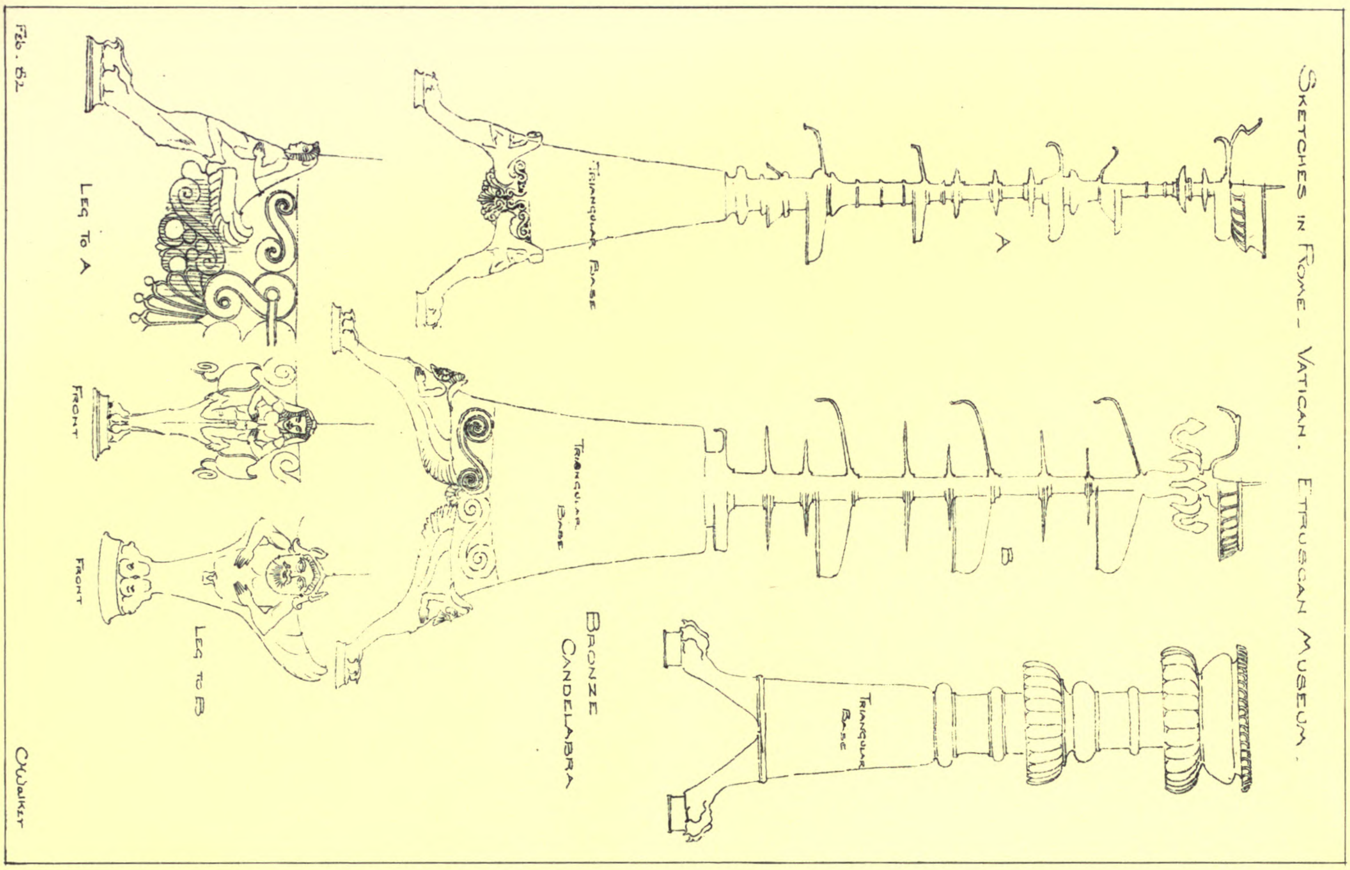


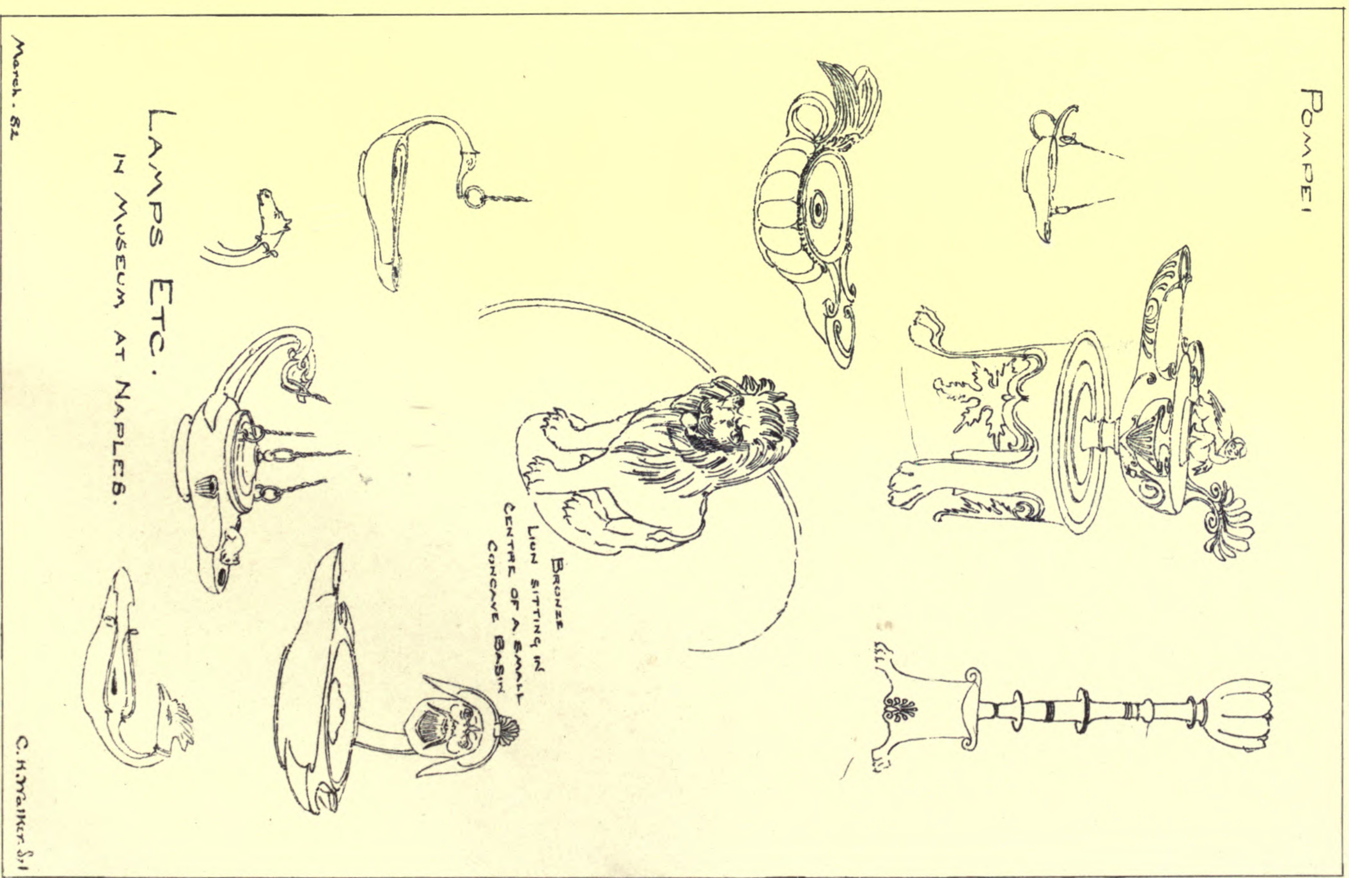
Perspective View from the Northeast, showing the Station completed. Rough southerly Sea

G. L. Gillespie
L. H. Engineer

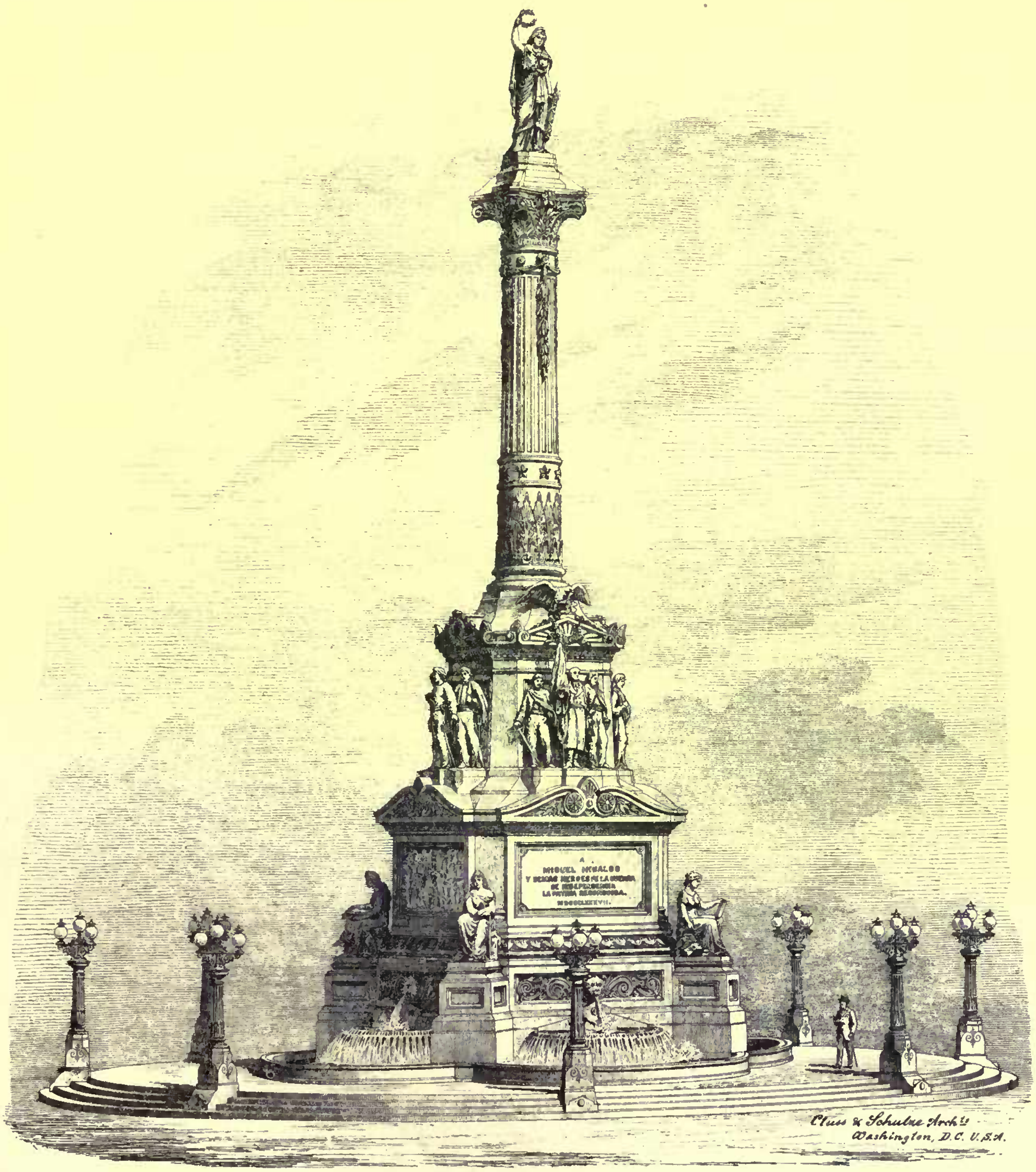
Drawn by F. M. Tabor

Heliotype Printing Co. Boston


SKETCHES IN ROME – VATICAN. ETRUSCAN MUSEUM.
A
TRIANGULAR BASE
B
TRIANGULAR BASE
TRIANGULAR BASE
BRONZE CANDELABRA
LEG TO A
FRONT
FRONT
LEG TO B
Feb. 82
C Walker


POMPEI
LAMPS ETC.
IN MUSEUM AT NAPLES.
BRONZE LION SITTING IN CENTRE OF A SMALL CONCAVE BASIN
March. 82
C. H. Walker Sc.

AMERICAN ARCHITECT AND BUILDING NEWS, APR. 16 1887. No. 590



Heliotype Printing Co. Boston.

this point does not concern the white-lead manufacturers, who never make their own lead, and buy it as above described, and under the commercial style of "soft lead doubly refined," (*plomb doux, double raffiné*). In order to manufacture white lead under favorable conditions, the works should be situated in a country where the raw material can be obtained cheaply, and in the vicinity of a large city to have an abundance of manure available. To obtain the acetic acid is always easy enough, as it can be distilled from the wood of any forest.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

ST. THOMAS'S CHURCH, AND THE HOUSES OF W. SEWARD WEBB AND H. MCK. TWOMBLEY, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial Edition.]

MONUMENT COMMEMORATIVE OF THE WAR OF INDEPENDENCE OF THE REPUBLIC OF MEXICO. PREMIATED DESIGN. MESSRS. CLUSS & SCHULZE, ARCHITECTS, WASHINGTON, D. C.

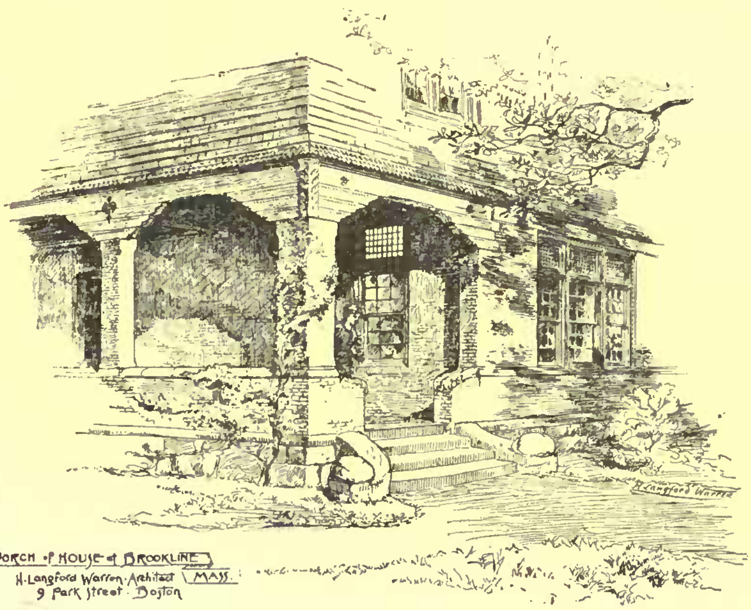
THE Government of Mexico instituted on January 20, 1886, an international competition for designs of a national monument to be erected in the City of Mexico, in commemoration of the freeing of Mexico from Spanish rule. According to the programme, it is to consist of the best marbles of Mexico, and to include statues of Miguel Hidalgo and other prominent leaders in the cause, bas-reliefs, allegorical figures, votive inscriptions, etc. Fountains are to be arranged in connection with it.

The usual measures were taken to conceal the names of the competitors until after the award was made, and in addition precautions were taken to conceal the names of defeated competitors who did not wish to be exposed. A jury of five disinterested experts was to decide on the artistic merits of and cost under the different plans, and report its reasons for arriving at a verdict. The artists of the preferred design were to be rewarded by an order for the execution of the work under the conditions customary with the profession. The competition closed on December 31, 1886, when five eminent architects and engineers were at once appointed as members of the jury. They reported on January 27, 1887, selecting the design under the motto:

"Libertad, don del Cielo,"

"Remedio de todas los males."

The Government accepted the verdict of the jury. The Government also communicated the decision to the successful architects, proposing a personal interview in Mexico for the purpose of discussing the cost of the monument, for which the architects had estimated the sum of $440,000, which probably can be reduced when all the local conditions are known. The total height of the monument is one hundred and nine feet. The diameter outside of steps of promenade is ninety-four feet. Height of crowning statue (to top of head) fourteen feet. Height of statues of upper pedestal, ten feet.



PORCH OF HOUSE AT BROOKLINE MASS.
H. Langford Warren, Architect
9 Park Street · Boston

TILLAMOOK LIGHT-HOUSE, OREGON.

FOR description see the following article.

HOUSE AT BROOKLINE, MASS., FOR PROF. CHARLES R. CROSS. H. LANGFORD WARREN, ARCHITECT, BOSTON, MASS.

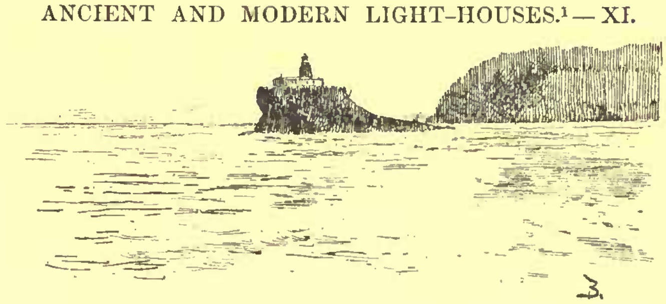
THIS house, about to be erected on Walley Street, is to be of brick in the first story with a wooden frame, shingled, second story. The piers of the porch are of brick with terra-cotta caps and moulded brick bases. The ornamental parapet caps on each side of entrance to porch are of terra-cotta, and the window-sills and sill-course are of moulded brick laid in cement. On the brick piers of the porch rest wooden beams, projecting one beyond the other, to form brackets. Their ends are carved like modillions with acanthus leaf. The porch has an open timber roof.

HOUSES FOR MR. C. W. WARD. MESSRS. BEALL & HAAK, ARCHITECTS, NEW YORK, N. Y.

THE illustrations show a design for three dwellings, to be erected on one city lot, 25′ 0″ x 100′ 0″. The fronts are to be of Philadelphia brick, terra-cotta and Carlisle stone. The steep-pitched roofs are to be covered with Spanish tile; carved finials on third story, and dormers to be of terra-cotta. Vestibules and halls to be finished in dark oak; also dining-room. Parlor to be finished in cherry. Upper floors to be finished in white pine. The cost of the three houses will be about $30,000.

SKETCHES IN THE VATICAN MUSEUM AND AT POMPEII, BY MR. C. HOWARD WALKER, ARCHITECT, BOSTON, MASS.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — XI.



THE sea-rock light-houses of the world are few in number; the following is a list of all, including those already described: Eddystone; Bell Rock; Bishop Rock (1853), off the Scilly Islands; the Small's Rocks, entrance to the British Channel; Hanois Rocks (1862), Island of Alderney; Barges d'Olonne (1861), west coast of France; Wolf Rock (1869), off Land's End, England; Alguada Reef (1865), Bay of Bengal; Great and Little Basses Light, off the coast of Ceylon; Minot's Ledge, Boston, and Spectacle Reef, Lake Huron.

The examples selected show sufficiently well the various difficulties and dangers attending this class of work, and how they were overcome in each case; so it is not considered necessary to give detailed descriptions of every work of this kind.

Though the above are all the sea-rock light-houses properly so called, yet there are many light-houses in this and other countries which are built upon isolated rocks in the sea, yet these rocks are sufficiently above the surface of the sea, to afford a moderately safe base of operations when a landing has once been effected upon them. Among these latter may be mentioned John of Unst's House, or "North Unst." The erection of this tower, finished in 1854, though not offering difficulties comparable to those at the sea-rock light-houses described, yet was a work of much interest. As shown in the sketch it is rooted upon an isolated rock, near the Shetland Islands, called Muckle Flagga; the tower is sixty-four feet high, and the light is two hundred and thirty feet above high water, and can be seen twenty-one miles away.

The north face which is perpendicular, is exposed to the full fury of the ocean; while the south face, though less abrupt, is extremely difficult of ascent; the summit is just large enough for the foundations of the tower which contains the lantern-room, bed-room, kitchen and office. At its base is the store-room for oil, coal and water.

Landings are only possible in fine weather. There are four keepers, those not on duty live on the Island of Unst, about four miles from the light.

TILLAMOOK ROCK.

On June 20, 1878, Congress appropriated $50,000 for building a light-house on Tillamook Head, and on June 16, 1880, appropriated $5,000 more for continuing the work. On March 3, 1881, there was appropriated $25,000 for completing the work *on the rock of Tillamook*. There were many reasons for this change: the Head is inaccessible by sea, so that a road about twenty miles long would have to be built and maintained through an unknown and difficult country; the crest is too high above the sea for a light to be visible during foggy weather; and there is no natural bench or lower level where the light could be placed, which would not be endangered by land-slides.

Maj. G. L. Gillespie, Corps of Engineers, U. S. A., Brevet Lieut. Col., was then in charge of this work, and in June, 1879, he

[1] Continued from page 148, No. 587.

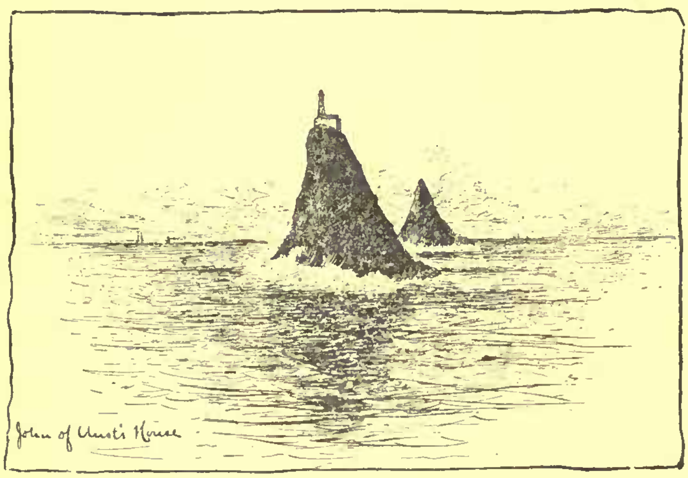
made an inspection of the rock from the deck of a light-house tender, the sea being too rough to permit a landing; he reported as follows to the Light-House Board:

"I was enabled, however, to approach sufficiently near to become convinced that the rock is large enough, and the only suitable place for the light. To be efficient, the light should be exhibited as low as it is safe to have it; the headland is entirely too high, even on the lowest bench, and if located ashore, a costly road must be built. Though I could not make a landing, I am of the opinion that it is practicable to use the rock for a light station, and am desirous of being allowed to make the attempt."

As will be seen farther on, the great difficulty was in effecting a landing on this rock, around which the sea is almost constantly boiling and surging even in moderate weather.

In June, 1879, Mr. H. S. Wheeler, superintendent of construction, went to the rock, and succeeded in landing two men, but they were unable to do anything, as the sea commenced to rise, so fearing that they would be separated from their companions, they jumped into the sea, and were rescued by life-lines. On the 25th of the same month, Mr. Wheeler made another attempt which was more successful, as he succeeded in landing in person, and by means of a tape-line, taking measurements of the most important dimensions.

The plan for the buildings and the course to be pursued in adapting them to the rock was, in general, the occupancy of the rock by a small working force, well supplied with provisions and tools for a stay of four or five months, with instructions to first prepare quarters for themselves, and then to reduce the summit of the rock by blasting until a level was reached, above the destructive action of the sea, sufficiently large to contain all the necessary buildings.



While this work was going on, it was proposed that all the various appliances, such as derricks, engines, etc., should be got ready and sent to the rock as rapidly as possible, and that all the stone should be quarried, dressed to dimension, and shipped to Astoria ready for use, together with all other needed material, such as cement, sand, brick, etc.

Before any work was definitely ordered to be begun, it was necessary that the rock should be carefully surveyed by a competent person, so that the proper places for the quarters, derricks and engines could be selected, the size of the force be determined, and other useful data collected.

Mr. John R. Trewavas, a master-mason of Portland, Oregon, was selected for this work. He had at one time been employed upon the construction of Wolf Rock, England, and was a most capable man. He attempted to land on the 18th of September, and he, with a sailor named Cherry, had succeeded in reaching the eastern slope of the rock; as Trewavas stepped on the wet slope he slipped and fell and was almost instantly swept off by a receding wave. The sailor jumped into the sea and made a gallant attempt to rescue him, and the boat's crew, with life-lines, rowed quickly to the spot where he was struggling, but the poor fellow was drawn under by the undertow and his body was never recovered. This unfortunate accident prejudiced the public against the work, and it became necessary to act with vigor before the public mind became so saturated with the idea of danger that it would be impossible to obtain labor. In this emergency Mr. A. Ballantyne was appointed superintendent, with orders to organize a party of eight or nine skilled quarrymen, to make a lodgment on the rock, to prepare comfortable quarters, and to proceed at once to reduce the crest to the level previously adopted.

On the 21st of October four men were successfully landed, with their tools, provisions, supplies, and an abundant supply of canvas to form temporary shelter. Five days later the rest of the men, additional supplies, and a small derrick were placed on the rock, and this may be considered the date of the commencement of the work.

The building of this light was dependent upon the occupancy of the rock and the erection of appliances for making the landings with safety and despatch, it is proper, therefore, to note the successive steps which led to the successful completion of the plans and to properly understand the various operations, it is necessary to give a description of the rock and its surroundings, and also of the manner in which the landings were effected.

Tillamook Rock is a bold, basaltic rock, standing isolated in the Pacific Ocean, about a mile off Tillamook Head, and twenty miles south of the mouth of the Columbia River, Oregon. The water on the west, north and east sides is from one hundred and fifty to two hundred and forty feet deep, but shoals to ninety-six and one hundred and four feet on the south side, over a limited area. Midway between it and the Head is a small rock, awash at low water, upon which the sea breaks heavily during storms. As it rises from the sea the face of the rock is somewhat precipitous on the west side for the first fifteen feet and then breaks back under a gentle but very irregular slope for a short distance, forming a narrow bench on part of the south face, and all of the west and north faces. As it springs from this bench it takes a remarkable form; it rises to a height of eighty feet, terminates in a rounded knob, resembling the burl of a tree, and overhangs the sea. The south side is bounded by a deep fissure dividing the rock into two unequal parts. This fissure is about twenty-five feet wide, and, starting on the sea-face, near the water-level, rises on an incline to thirty feet above the sea, where it is abruptly closed by a natural wall forming part of the east slope; into this fissure the waves break violently during storms, throwing their spray to the very top of the rock, and at times leaping over the resisting wall, sweep down the opposite slope.

The detached portion of the rock on the south side of the fissure is a narrow spine, whose surface is rendered very irregular and rugged by scales of rock resting against its sides, and by sharply-pointed needles projecting above its surface. Before the crest of the principal portion of the rock was disturbed it was exceedingly irregular in shape and measured only about one hundred square feet. Little needles projected everywhere, forming narrow and deep crevices, in and through which, extending some distance down the east slope, was a mass of various-sized cubical blocks, from three to twelve inches on a side, cemented together with a tough and unyielding matrix, the original columnar formation having been destroyed and these being the remains.

The earliest records show that this rock has been a favorite resort for thousands of sea lions — a large species of seal, valuable only for oil — which, before the work commenced, completely covered the slopes and even the summit of the rock. At first they were quite hostile and disposed to discuss with the workmen the ownership of the rock, but eventually retired to rocky resorts farther to the southward.

As has been shown, it was both difficult and dangerous to land on the rock; it was equally so to leave it in a small boat, as there is no harbor within twenty miles where a landing could be made with safety; no light-keeper would ever attempt to row ashore unless he were a skilled boatman and was driven by an urgent necessity.

The first landing was, of necessity, from a boat, but this involved so many dangers to life that a plan of procedure was adopted which would restrict the dangers encountered to the smallest number of men practicable. When the four men landed, on the 21st October, the revenue cutter, which brought them, moored to the spar buoy — previously placed about three hundred feet from the rock. The surf-boat, which had landed the men, returned to the cutter and received the end of a four-and-one-half-inch rope which had previously been made fast to the mast of the vessel, and carried it to the rock. The outer end was then run up the slope and wound round a projecting ledge eighty-five feet above the sea, and drawn taut from the vessel. This main line, which is called the "cable" was rigged with a large single block, called the "traveller," which moved freely along it and carried a large projecting hook underneath, and two fixed blocks, one at the vessel the other at the rock. The traveller was designed to be hauled back and forth along the cable, from the deck of the vessel, by an endless line made fast to the hook of the traveller, one branch going direct to the vessel from the hook, and the other returning after passing through the block at the rock. The object of the traveller was to furnish means for transferring men and supplies from the vessel to the rock with facility and security, if not with comfort; the articles subject to injury from water were enclosed in tight casks slung from the hook attached to the traveller; by hauling on the lower and easing off on the upper line the traveller could be drawn from the vessel to the rock; by reversing the process the traveller would return. The men were transported by an arrangement known as the "breeches-buoy" consisting of an ordinary circular life-preserver, slung from the traveller, to which were securely lashed a pair of stout breeches cut off at the knees; the latter would support the man right side up while in the air, and the former would keep him afloat should he fall in the water. After the buoy was attached to the traveller the man would take his position in it facing the rock, and be hauled out in the usual way. The plate shows the details of the operation. It was never possible to keep the cable taut as the vessel was in constant motion, sometimes very violent; for this reason the traveller ran, at times, very close to the surface of the sea, and it was not unusual to have the passenger or the package dip under several times while making this very unattractive "rapid transit."

As soon as the necessary men, tools, etc., were landed, the vigorous prosecution of the work depended upon fair weather alone. The first fifteen days were devoted to providing shelter for themselves and supplies. There were no caves nor recesses in which they could take refuge, so the only shelter which could be obtained against the

driving rains was by cutting up the canvas into A-tents, which were held down by rope-lashings made fast into ring-bolts in the rock. In a short while a bench was levelled in a retired spot on the south side near the ninety-foot level on which it was intended to place a frame house for sleeping-quarters; but the attempt had to be abandoned as it was soon found that the site selected was subject to be deluged by the waves which broke in the fissure; so the quarters were located on the north side. As soon as they were completed a site for the main derrick was levelled near by. A rude pathway was excavated from the landing at the thirty-foot level to the quarters, and a bench was commenced at the ninety-foot level, to be carried around the rock. This was necessary as the crest was so irregular and narrow that but few men could work on it in concert, and was, moreover, so wind-swept that it was dangerous to remain on it during a gale.

The outer surface of the rock was covered with thin scales, and could be readily removed with moderate charges of black powder. The nucleus was very firm and tough; black powder made but little impression on it; but by opening the mass with giant-cartridges and then using large charges of black powder the rock was blasted with better success.

The hardy little party of quarrymen, notwithstanding their constant exposure to danger and the discomforts of their rude quarters, worked diligently all winter without complaint, and by May 1 the rock had been reduced in height about thirty feet by the removal of four thousand six hundred and thirty cubic yards of solid rock.

Early in January, 1880, this coast was visited by a terrific tornado which caused the waves, after rebounding from the face of the rock and filling the fissure, to be thrown by the winds entirely over the rock at every point continuously and uninterruptedly for many days, carrying away by their impetuous descent down the opposite slope the supply-house on the thirty-foot level, endangering even the quarters of the men. The storm reached its maximum during the night of the ninth, when the men were in their bunks. To the courage and presence of mind of Mr. Ballantyne the party owed its safety; his determined action arrested a panic and prevented the men from deserting their little house for an apparently safer refuge on a higher level, an attempt which could only have been followed by their destruction so dark was the night and so violent the wind. The supply-house was a slight structure, and, for want of a better locality, had been established temporarily at the thirty-foot level. Fortunately the superintendent had stored in the quarters plenty of hard-bread, coffee, and bacon, to last, with economy, for several months.

It was not until the 25th of January that the storm subsided sufficiently to allow a vessel to cross the bar at the mouth of the Columbia River, to render assistance to the force, or to ascertain the truth of the reports adverse to their safety, which had been so freely circulated, and which had had their origin in the wrecks washed upon the beach north of Tillamook Head. She found all safe and well, though in want of fresh provisions.

On the same night that the safety of the workmen was so endangered, the English Iron bark "*Lupata*," of ten hundred and thirty-nine tons' burden, was dashed to pieces on the main shore, not a mile from the light-house, with the loss of every one of the twenty persons on board. She came so near the rock that the creaking of the blocks and the voices of the officers giving orders could be distinctly heard, but the night was so dark that nothing could be seen except her lights. The superintendent had a bonfire built on the rock as soon as possible, but the vessel was probably lost before the light could be seen.

By the 30th of May, all of the rock was removed to the required plane, without accident of any importance. During the work an attempt was made to fill the fissure with the débris, but without success, the waves promptly removing every fragment thrown in, though many of them were of large size. As soon as the rock had been levelled, the work of landing the material for and of erecting the tower, dwelling, fog-signal, etc., was at once commenced, and was much expedited by the use of the boom-derrick and of the large derrick shown on the drawings, which also give the general appearance of the buildings.

The dwelling is a one-story stone structure, forty-five by forty-eight feet, with an extension for the fog-horns twenty-eight feet six inches by thirty-two feet, under the same roof on the west side.

The light, which is of the first order, showing a white flash every five seconds, is exhibited from a stone tower sixteen feet square, rising from the centre of the main dwelling.

There are four keepers at the station, and there is ample storage-room for six months' supplies.

The corner-stone of the dwelling was laid on the 22d of June, 1880, and the station was completed on the 11th of February, 1881, though the light had been exhibited about three weeks before.

The total cost of the work was $123,492.82. Since the station has been built, the landing-stage has occasionally been destroyed.

There is no doubt that this light station is one of the most exposed in the world. Every year it is visited by severe storms. As an example of the height to which the waves can reach, and of their power, I quote the following, from an official report: —

"On December 16 and 17, 1886, the seas from the southwest broke over the rock, throwing large quantities of water above and on the building. The roof on the south and west sides of the fog-signal room, and on the west side of the building, were crushed in. . . . The concrete covering of the top of the rock around the building was broken, and a brick parapet and concrete filling in a low place outside the fence, at the south-east corner, were carried away. A mass of the filling weighing half a ton was thrown over the fence into the enclosure. Three 730-gallon water-tanks filled with water, at the west end of the building, were broken from their fastenings and piled against the fence."

Considerable other damage was done, but this is enough to show to what a great height and with what force the waves are thrown on this remarkable rock in the *Pacific* Ocean.

THE NIAGARA FALLS HYDRAULIC TUNNEL.



THERE was probably nothing more interesting, from an engineering point of view, in connection with the construction of the thirteen-mile tunnel beneath Mount St. Gothard than the arrangements made for substituting water-power for steam in running the rock-drills and performing the various operations necessary for carrying on the work. The success was complete. At Mulhausen, again, although the stream at disposal is comparatively small, it has been turned to account to supply the numerous adjacent factories with motive-power at so small a cost that they are enabled to compete successfully with their more favorably-situated rivals. Experience on the Reuss and on the Rhine has demonstrated that the profits derivable are practically in proportion to the quantity and head of water available; hence it is not unreasonably estimated that where, as at Niagara, there is an immense volume of water representing seven million horse-power, the field for water-power company enterprise is unlimited. It is to exploit this field that the Niagara Falls Hydraulic Tunnel and Power Company — with a share capital of £2,200,000, and a debenture capital of £1,100,000 — is being organized. The company has secured a charter, granted by the Legislature of the State of New York, whereby they acquire the right to construct an hydraulic tunnel and to utilize water estimated at 1,000,000 horse-power at Niagara Falls, and the vendors express their willingness to enter into contracts to take from the company one-third of their water-power and land at a rental of £375,000 per annum, which is equal to a dividend, after paying interest on the debenture and preference stocks and expenses of management, of over twenty per cent per annum, and, assuming the whole 1,000,000 horse-power to be employed, the profit would be increased by over twenty per cent more. These are, of course, speculative calculations only.

The first question naturally asked with regard to the enterprise will be — Is the project feasible and unattended by insuperable engineering difficulties? The reply is simple and conclusive. Nothing but an ordinary mining tunnel has to be driven, and no difficulties worth mentioning are likely to be encountered. The Mont Cenis, the Hoosac, the Saint Gothard, the Sutro, the Cornish County adit, the twenty other great engineering works which have been successfully accomplished, all required vastly greater engineering skill than will be needed at Niagara; indeed, it may safely be said that, but for its being in the vicinity of the great falls, the tunnel, as a feat of mining engineering, would attract no attention at all. It is only such a tunnel as has been made at nine-tenths of the great mines in the United States and Australia in the ordinary way of business, for it must be understood that the difficulty of making a tunnel does not depend upon its length, but upon the obstacles to getting a reliable survey quickly, and upon the absence of facilities for putting down shafts so as to work several parts of the tunnel simultaneously. At Niagara no obstacles whatever of the kind alluded to are met with. It is remarked that the first considerable use of water-power at Niagara was accomplished some ten years ago by the running of an hydraulic canal, about one mile in length, from Port Day to a point below the Falls. This has been successful as far as it went, and it affords excellent power for a number of large mills and factories along its route, and for illuminating the falls and lighting the streets, public buildings, etc., by electricity. Many applications have been made by large manufacturers, who proposed building factories on the spot, but they have necessarily been declined, as the canal is practically utilized to the utmost of its capacity. The time has, therefore, arrived when an enterprise to some extent commensurate with the possibilities of the place should, in the opinion of the highest authorities, be undertaken, with the certainty of yielding eminently satisfactory results.

The economy of water-power as compared with steam is well known, but in most cases the quantity of water-power available diminishes as the country becomes more thickly settled. This diminution has been especially observable in America, and it is truly stated

that at many places there it has become necessary to supplement the water-power with steam in order to be able to run machinery during the entire twenty-four hours, thereby greatly increasing the cost of production. Most of the water-power in use in various sections of the country has been produced by the construction, at great cost, of dams for the storage of water during the dry season. These devices have, at times, proved inadequate to supply the water required for manufacturing purposes, and at other times, when freshets prevailed, the dams have given way, depriving the manufacturing establishments of power, and inflicting great damage upon the adjacent country. The cost of constructing dams, the unreliability of the water-power in such places, and the isolated location of many establishments on railroads, where rates are high, owing to a lack of competition, place manufacturers under great disadvantages, with those who have the benefit of a steady power, and abundant railroad and other shipping facilities. At Niagara, Nature has built an imperishable dam from the solid rock, which she maintains without cost to man, so that the manufacturer who avails himself of this power is relieved, from the beginning, of all anxiety about his dams ever giving way and causing death and destruction of property. He is also assured that his mills can never stand idle for lack of water, because, instead of being dependent upon some slender and fickle stream, he draws his copious supply from the mammoth reservoirs which constitute the great chain of lakes. There will, therefore, be nothing to interrupt the steady flow of the manufacturer's yearly production at the minimum of cost. His means of bringing his products to the consumer are also of the best.

As to the practical progress made, it is reported that within the last twelve months sufficient land along the river has been secured, surveyed, and apportioned into mill-sites fronting on the river and on the line of the proposed tunnel, with ample streets and dockage, affording facilities for approach by rail or water, to accommodate, according to the engineers' estimate, 400 dynamo-sheds, mills, and manufactories, of 500 horse-power each, or 200,000 horse-power in all. Some idea of the magnitude and value of this power may be formed when it is stated that it far exceeds the combined available power in use at half-a-dozen large manufacturing cities in the United States; whilst basing the calculation upon careful estimates of the company's engineers and the report of the cost of construction of the works will not exceed £2,500,000 for the main tunnel, twenty-four cross-tunnels, docks, conduits, etc., for laying out sites for 400 dynamo-sheds, mill-sites, and manufactories, with streets 100 feet wide between the rows of mills, and with also 100 feet reserve between the rows of lots in the rear, for railway-sidings, and to allow each site an average of 500 horse-power with conduit and cross tunnel, bringing the water within 50 feet of each lot. Fifty or more of these lots are to be made accessible for lake and canal vessels, so that the business of the place can be carried on under the best possible conditions. As to the company, it has some prospect of earning profits, and hence it may be entitled to the support of capitalists when the prospectus is issued; but at present the most that can be said is that the project is feasible. The practicability of the scheme, from an engineering point of view, will be considered in a future *Review*. — *Industrial Review.*

BOOKS AND PAPERS.

WHAT a great "art" nation we are getting to be, to be sure! and with what complacency we all believe that if the apostles of true art were not all born in America, there are those here who are quite as good apostles as the real ones, in whom the rest of the world has so long believed. It is a characteristic American idea that everything — trade, class, profession, club and body politic — must have an "organ," and there seem to be always those who, as soon as one feeble effort succumbs to the inevitable, are ready to start another on its brief organic career. Money gain is the real end and aim of most; the existence of the "long-felt want" is really very feebly felt, and as for a real downright honest "call" to do, to preach, to plead, to teach, there isn't one heard in a lifetime. The puzzle, after all, is not so much why these organs come into being as why it is that any one of them more than any other should cease to exist; because, of the fairly good ones, one is about as good as another. We suspect that their untimely demises may be due to the fact that after all we are not such a highly cultured and artistic community as we would like to believe. There are some who appreciate and are willing to support a really first-class publication of any kind, but they are too few to keep alive all the art journals, reviews, magazines and quarterlies that are now being published, and which will give place, sooner or later, to others more or less of kin to them. It may have a heartless air, after thus expressing in a general way the belief that art publications, so called, are not really at home in the practical atmosphere of American daily life just now, to seem to point the moral by speaking of any of the newer journals of the class whose presence amongst our exchanges we have not yet acknowledged.

Once there was a really first-class art journal published in America, the *American Art Review:* its decease, for lack of circulation, we believe, would take place now just about as surely as it did ten years ago. The times are not ripe, and we question whether they will be in our generation, for the support of a proper embodiment of such real American art as does exist. When that time comes, the real art journal will be supported by its subscribers, but until then it will be supported, as now, largely by its advertisers, and it will be as impossible as now to disguise the "shop." *American Art,*[1] a Boston publication a few months old, has the twang of the commercial tout very strongly marked, and one is repelled by the suggestion of the paid notice, which is, perhaps, created by its endeavor to find sufficiently interesting and valuable material in the shops that every one frequents, the proprietors of which advertise persistently, even in the pages a little farther along in the back part of the pamphlet.

The *Art Review,*[2] on the other hand, a New York monthly, which is also a few months old, is good in tone and make-up, and, so far as its limits go, is more nearly a worthy successor of the *American Art Review* than any other. Still, as one turns over its pages and runs his eye down the columns, he cannot help asking himself whether this is worth while, whether there is a reason for the existence, not of this particular journal, but of such as this. Here we find precisely the same kind of writing, criticism or dissertation that we find in the great popular magazines, *Harper's* and the *Century,* often by the same writers as here. And more than this, we can find just as good essays, criticism and dissertation in a dozen of the great daily newspapers of the country — particularly in their Sunday editions — and here again, often, by the same prolific writers, teachers, American apostles of high American art. What is it, then, that makes it worth while to publish journals of art? First, their decency of make-up; next, the fact that they have a certain temporary stability and permanence; and last, because they are illustrated. The illustrations of the *Art Review* are mainly photogravure prints, which, mechanically speaking, are good. Unfortunately, much of the excellence of a photogravure plate depends on the hand-work that is put on the plate after it is made: if the retoucher is an artist and the printer is skilled, the result is all that can be hoped; but a bungler, a man who will put lights where there should be none, and high-lights where should be half-tones, is not the man to do work for a first-class periodical.

The forces that engender building and architectural journals seem even more prolific than those which are responsible for the art journals. The latest — we say it with some diffidence — architectural newcomer is the *Architectural Era,*[3] which is a well-appearing monthly of some sixteen pages, which seeks distinction through being printed in brown ink. More than this it is hard to say, on the score of its individuality, for what could be said of the *Architectural Era* could be said with equal truth of half-a-dozen other not very antiquated building papers, any one of which, if there were not half-a-dozen others just as meritorious, would be deserving of a satisfying appreciation and a satisfactory pecuniary support.

The advent of each new art or technical periodical nowadays always bring to mind the saying which is, we believe, credited to Commodore Vanderbilt, who, sardonically watching the frantic efforts of "the street" to obtain an interest in some watery boom he was manipulating, is said to have exclaimed, in a moment of temporary soft-heartedness, "God help the man who buys the last hundred shares!" It seems to us that these journalistic enterprises cannot all escape wreck, and our advice to any intending publisher who hopes to escape the fate of the earthen pot in its journey down stream, is to find out from the publishers of a successful journal how many years it will be necessary to maintain his venture at a loss before he can hope to find his balance appearing on the right side of the ledger. These pessimistic remarks are not directed at any or all of the journals we have mentioned above, but are suggested by the phenomenal increase of publications of these classes which have achieved a more or less brief existence. Heaven help the readers and students of succeeding generations who seek to cull the few good grains from the mass of chaff the printing-presses of this day are turning out in such vast quantities!

It is a relief to turn from this uninviting prospect to speak of the step in advance that had recently been taken by the *Inland Architect,* which is, perhaps, no less worthy of commendation because it falls exactly in the foot-prints we have left behind us. The great advance that has been made in photographic printing-processes puts within the reach of those journals which have the means, the possibility of greatly increasing the value of their illustrations as compared with those which, in our younger days, we used to find in similar publications. The gelatine prints which the *Inland Architect* adds — for a price, be it understood — to its other illustrations, being massed, as it were, in its twelve issues, give to each a more attractive air than is possessed by a single copy of any other publication of the class. The excellence of the illustrations in this journal are a standing illustration of how much easier it is to gather interesting material for twelve issues than it is to find them for fifty-two. The gelatine prints included in the issue of March exhibit a very interesting phase of house-building which, as the houses are built in a city, may be described as semi-detached single houses, that is, the houses are not built in rows, but each with four independent walls, with windows on each side, and it is this feature that makes us call them semi-detached, for the space between the houses is so narrow that the inhabitants of one are dependent on the movements of those in the other for the right to enjoy the windows in their side-walls unre-

[1] *American Art,* illustrated. A monthly magazine. Boston: American Art Magazine Co. $2.50 per year.
[2] *The Art Review,* issued monthly at 59 Carmine Street, New York. $6.00 per year.
[3] *The Architectural Era:* an architectural journal published in monthly parts. D. Mason & Co., Syracuse, N. Y. $3.00 per year.

strained by the presence of onlookers from the adjoining house. Another feature, local in its character, is the exuberance with which carving in stone and moulding in terra-cotta is employed.

A few months ago the *Journal of Proceedings* of the Royal Institute of British Architects was one of the dreariest publications that an American could, in his folly, take up for perusal. But during the past year a great change, almost transformation, has taken place, and the journal, instead of being only of interest to members of the R. I. B. A. — and to them in only a slight degree, we venture to assume — is now a publication which may be read with pleasure and interest by any one.

The value of the photographic printing-processes to technical publications is instanced, as clearly perhaps as in any way, by the presence of gelatine prints of machines in a new French journal, *Machines-Outils*, a publication, the owners of which, if its career had begun three years ago instead of to-day, would never have dreamed of using a process which, though known and used, was so costly as to be beyond the reach of merely utilitarian journals.

SOCIETIES

A STUDENTS' ARCHITECTURAL SOCIETY.

AN architectural society has been formed at the Massachusetts Institute of Technology. Any person having been connected with the Architectural Department of the Institute may become an associate member of the society. All such persons desiring to become members are earnestly requested to send their names and addresses to the secretary, FRANK A. MOORE,
Massachusetts Institute of Technology, Boston, Mass.

COMMUNICATIONS

QUESTIONABLE "BENEVOLENCE."

MINNEAPOLIS, March 18, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I have been interested of late in your notes on the subject of disputed bills of architects, and I take the liberty of sending you a letter just received, which will explain itself.

It often occurs to me that these unexpected offers to contribute plans as a matter of benevolence is one of the causes which make it hard for the public to see the justice of reasonable bills.

Yours truly, JAMES C. PLANT.

MONTEVIDEO, Minn., March 14, 1887.

Dear Sir, — I mailed the plans you kindly loaned me, on Saturday. They served the purpose I wished — to favorably introduce you to our Board.

After my visit, and unexpectedly, an Eastern architect offered to contribute the plans and details of our first building, as a matter of benevolence — which, of course, "defies competition." His past success as a builder leads us to hope for satisfactory results.

Thanking you for the pleasant interview afforded me, and hoping we may have the benefit of your skill at some future time, I am, very sincerely yours, ROBERT P. HERRICK.

A SKETCHING TRIP THROUGH ENGLAND.

PHILADELPHIA, PA., April 9, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I am planning a three months' bicycle tour of England, with sketching as a main object. Will you kindly inform me, through your columns, what architectural books to consult, in order to shape my course intelligently, with a view to getting the most instruction and the best sketches? By so doing you will greatly oblige

A SUBSCRIBER.

[As practical advice is worth more than theoretical suggestion, we have submitted this matter to Mr. E. Eldon Deane, who makes the following recommendations: 1. Domestic work should be sought for in preference to ecclesiastical, and can best be found in the old half timbered and brick houses and halls of Somersetshire and Wiltshire, the old timber and plastered houses of Cheshire and Lancashire, the old halls of Yorkshire and Derbyshire, of stone. 2. The ecclesiastical work would be too overwhelming for a three months' trip, but a study of some of the smaller and out-of-the-way churches, say, in Sussex and Kent, also in Norfolk and Suffolk — the two latter counties affording examples of stone, flint and brick work. 3. Take boat to London direct (see it in the season). Commence in the south first, for the weather is cold and uncongenial in the north until July. In London call on Mr. G. N. Millard, 5 Bloomsbury Square, who has travelled England systematically, and who will gladly assist in directing any sketching student the best routes to take. They need to be studied out on the map. Cambridge and Oxford, particularly the former, offer some quaint bits of domestic work, as, also, Bristol, Shrewsbury, Coventry. 4. The abbeys of Yorkshire are inspiring in grandeur, but need a special study. There are fine stone churches and spires on the east coast of Yorkshire, near Hull. In passing up north, Darlington is an interesting old town, Newcastle, Morpeth and Alnwick, the seat of the Duke of Northumberland, whose baronial castle, or Keep of Norman period, is treated in the interior after the Italian palaces, and affords a brilliant example of the stateliness of proud nobility's homes (apply to Mr. Holland, the Duke's agent, at the castle). 5. Durham, though affording one of the grandest of pictures, with its cathedral and castle, offers no more than these — sufficient for a three days' stay — then on to Edinboro' and Glasgow, and thence home. 6. While in London do not fail to see the Guard's Chapel, Wellington Barracks, St. James's Park, which possesses, I should say, the finest study of modern color-decoration in England, under the late G. E. Street, R.A., style Byzantine; few know of it or see it. Look out for Grinling Gibbons's wood-carving, in Hampton Court, near London, Chatsworth House, Derbyshire, and elsewhere. There is a small book published at South Kensington, to be obtained at the Museum, price 6*d*, giving the whereabouts of the churches and other buildings in England, affording examples of polychromatic decoration of ancient date, on walls, etc. — very useful for reference. 7. The roads in the north of England are very bad for bicycling, and if time is an object there is more than enough to study in the southern counties alone. Nash's "*Mansions of the Olden Time*"; the "*Architectural Association Sketch-Books*," and the "*Northern Sketch-Book*," published in Lancaster, both of which can be seen in the library of the R.I.B.A., London; "*Sussex Churches*," by Nebbs; "*Spires of England and Wales*," by —— ; *Churches of Northampton and around Cambridge*," by Paley; Brandon's "*Analysis of Gothic Architecture*"; Morris's "*Open-Timber Roof*"; Weales's "*Quarterly Papers*." There are many books on the old homesteads of England — county histories — all of which can be found and seen in London. Cotman has a fine book of etchings of the churches of Norfolk and Suffolk. "*Sharpe's Parallels*" gives the Abbeys of York; Habershore's "*Old Mansions of Lancashire*"; Johnson's "*Parish Churches*." The librarian of the R. Institute of British Architects would assist willingly in pointing out what books to refer to in such a trip, and if some reference is needed call on Mr. Phené Spiers, Carlton Chambers, 4 Regent Street. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

THE NELSON AND DUKE OF YORK MONUMENTS, LONDON. — A writer in the *Magazine of Art* for April, in speaking of some London monuments, says: From Wellington one naturally turns to Nelson, whose statue on the top of the column in Trafalgar Square suggests the notion that the admiral has been ignominiously mast-headed. This peculiar use of a lofty column, of which many examples are to be found at home and abroad, has little to recommend it beyond the vague idea that the honor paid to a departed hero is in some way proportionate to the elevation of his figure; and it is to be hoped that the mistake will never again be committed of honoring a man by placing his statue 150 feet from the ground, where it presents a singular appearance. The corresponding treatment of the Duke of York (with a spike on the top of his head, for the purpose, it has been said, of filing his unpaid bills) is a matter of comparative indifference; but it is none the less a discredit to the nation that when so many famous men are unremembered in our public sculptures, no less than £26,000 was provided half a century ago for the erection of a column to the memory of a prince who was an incompetent commander, and whose mistress sold the commissions which he had to bestow.

COMPRESSED WOOD. — The London *Engineer* describes the compression of beech and other woods by means of hydraulic presses, under the patent of Mr. Robert Pickles, of Broomley, England, who makes the wood a specialty for shuttles and for gearing. The compression of the wood improves its wear-resisting qualities to a degree that would be deemed impossible. The wood is first sawn into sizes necessary for making shuttles or cogs and naturally dried. It is then put under a pressure of about fifteen tons per square inch, in a rectangular space in the press, holding six shuttle blocks, three side by side and two deep. Above is a metal block made so as to fit the space in the ram. The depth of the blocks before compression is 2¼ inches, which is reduced to 1¼ inches. The woods generally used for this purpose are beech, cornel and persimmon. The grain is very close, and the weight of compressed beech is considerably greater than that of boxwood, and when compared with uncompressed beech, it is remarkably heavier. In regard to the wear of the wood for cogs it is stated that it will last a long time and run very easily.

THE BOYCOTT ILLEGAL IN CONNECTICUT. — Judge Carpenter's Supreme Court opinion in the boycott case of the State against Glidden was agreed upon and handed to the court reporter on the 1st inst. It defines the act of 1878, prohibiting threats of injury to property as including the boycott. The accused persons were convicted of conspiracy to boycott the proprietors of the New Haven *Courier* because they would not discharge non-union printers. "The question was," says the opinion, "Is this conspiracy illegal? Many acts are said to be unlawful which would not be the subject of a criminal conspiracy — other acts are unlawful because they are in violation of the criminal law or penal statute. If the ends or means are criminal in themselves, or contrary to some penal statute, the conspiracy is already an offense. The defendants and their associates said to the Carrington Publishing Company: 'You shall discharge the men you have in your employ, and you shall hereafter employ only such men as we shall name. It is true we have no interest in your business, we have no capital invested therein, we are in nowise responsible for its success, and we do not participate in its profits, yet we have a right to control its management and compel you to submit to our direction.' The bare assertion of such a right is," said the court, "startling. The two alleged rights cannot possibly coexist; one or the other must yield. If the defendants have the right which they claim, then all business enterprises are alike subject to their

direction. No one is safe in engaging in business, for no one knows whether his business affairs are to be directed by intelligence or ignorance, whether law and justice will protect the business, or brute force, regardless of law, will control it; for it must be remembered that the exercise of the power, if conceded, will by no means be confined to the matter of employing help. The exercise of irresponsible power by men, like the taste of human blood by tigers, creates an unappeasable appetite for more. Business men have a general understanding of their rights under the law and have some degree of confidence that the Government, through its courts, will be able to protect those rights. This confidence is the corner-stone of the whole business; but if their rights are such only as a secret and irresponsible organization is willing to concede to them, and will receive only such protection as such an organization is willing to give, where is that confidence which is essential to the prosperity of the country? Obviously such conflicting claims, in the absence of law, can lead to but one result, and that will be determined by brute force. It would be an instance of the survival, not necessarily of the fittest, but of the strongest. That would be subversive not only of all business, but also of law and of the Government itself. The end would be anarchy pure and simple. No one can drive these non-union workmen from their situations — numbers, if allowed their will, may do it. The intention by one man so long as he does nothing is not a crime which the law will take cognizance of, and so, too, of any number of men acting separately. But when several men form the intent, and come together, and agree to carry it into execution, the case is changed. The agreement is a step in the direction of accomplishing the purpose. The combination becomes dangerous and subversive of the rights of others, and the law wisely says it is a crime. Justin McCarthy's definition of boycott is cited, but the court finds the intent of the boycotters in this country to be tempered by American institutions. Boycott does not mean murder, but it is criminal and dangerous, and if it is not abandoned the courts, at no distant day, will be called upon to recognize its dangerous tendencies and treat it accordingly. From these considerations it is apparent that the purpose of conspiracy, or the means by which it was to be accomplished, or both, were not only unlawful, but, as some authorities express it, 'was in some degree criminal.' "

Anchor Ice. — The phenomena connected with the formation of ice in its different forms and with its action in our northern rivers appear to be, as yet, but imperfectly understood, even by scientists. Few places are better situated for studying this subject than Montreal. As good an example of the "ice shove" may be seen at our city every spring as anywhere in the country. This occurrence is of interest to the geologist as well as the engineer. A graphic description of the ice shove at Montreal, written more than forty years ago, by the late Sir William Logan, was among the earlier circumstances which brought Canada's great geologist into notice. The originating cause of the early winter and spring floods, which bring so much damage and annoyance upon the city, is still a subject of debate among engineers. It has been suggested that it may be due to the accumulation of frazil or anchor ice, which, perhaps, forms abundantly in the Lachine Rapids and lodges between the surface-ice and the botton over the extensive shoals opposite the harbor, thus plugging up and materially contracting the usual channels of the water. At the last meeting of the Royal Society of Canada a paper on ice phenomena was read by Dr. R. Bell, of the Geological Survey. Among the matters under this head which the paper deals with is that of frazil, and a theory is advanced to explain its origin. On account of the interesting and important nature of the subject, we quote the following from Dr. Bell's paper as to frazil: "This species of ice is familiar to almost every one in Canada. It forms as a spongy mass, in cold weather, on the stones in the bottoms of open rapids, in brooks and rivers, and sometimes under the open water, which is often found at the outlets of lakes. In clear weather it gathers abundantly around the boulders, and when these rest on other stones, or have only a narrow base of support, they are sometimes buoyed up by their icy envelope and floated or rolled away by the force of the current. Boulders of considerable weight have sometimes been known to be lifted by this means. When the weather becomes milder, or the sky overcast, the frazil rises to the surface or floats off, like a mixture of snow and water. Although the water may remain open beneath bridges or overhanging rocks and large fir trees, frazil is not observed to form in such situations. The cause of the formation of frazil has never been satisfactorily accounted for, so far as the writer is aware, until Dr. Sterry Hunt mentioned to him that he regarded it as due to terrestrial radiation, and to be analogous to the formation of hoar frost on the surface of the ground in clear weather. As long as rapid radiation is going on, the surface of the submerged stones will have a sufficiently low temperature to retain the ice. The chilly water supplies abundant material. In rapids the surging and churning motion would carry down the coldest water from the surface, probably charged with multitudes of fine ice-crystals, and throw it against the stones in the bottom, thus aiding the process. If this view of its formation be correct, the loosening of the frazil in mild or overcast weather would follow as a consequence — as well as the fact that, so far as we are aware, frazil does not form under obstructions to radiation, such as those which have been referred to. At rapids, in small rivers, where the bed of the stream is filled with boulders, the writer has frequently found a narrow and straight channel, sufficient to contain the whole stream at low water, excavated among them by the removal of the boulders. The latter are piled on either side, especially toward the lower end of the current, and they have evidently been buoyed up and rolled out of the bottom of the rapid. Judging from their various stages of weathering, and from the different quantities of moss and lichens growing upon them, these boulders have evidently been deposited along either side of the channel in many different years, showing that the process of excavation has been a gradual one. Some of them look as if they had been newly cast out of the bed of the stream. The phenomena just described are particularly observable in the numerous small rivers north of Lakes Huron and Superior, and are probably due to the action of frazil.—*Montreal Gazette.*

TRADE SURVEYS

In spite of the assurances that have been given in trade and manufacturing journals by employers themselves, as well as the leaders of labor organizations, that relations between employers and employés would be friendly, there are some evidences in cities like New York, Chicago and St. Louis, and some smaller cities, that a season of unrest among laborers is probable. After all, the alarm is without cause. The purposes of the labor organizations in general is to discourage the spirit of striking, and to encourage organizations to pursue a course that will draw out the most friendly expressions of sentiment and of action on the part of employers and the public press. The leaders of labor organizations are fighting for a favorable recognition by the public, and are endeavoring to strengthen themselves through the establishment of arbitrated methods, and through the application of legislative remedies, from the various city legislatures. An attempt was made recently in Pennsylvania to secure the passage of a number of labor laws, and similar attempts are being made, in a quieter way, in the legislatures of several States, East and West. Builders and investors need have no fears as to the general labor uprising, or no serious interference of organized labor itself with their plans and purposes. A few thousand discontented workmen connected with building trades in New York and Chicago, may agitate for minor advantages, to obtain them or not obtain them, but the general movement will be unrelieved by strikes, or of a demand which employers cannot afford to meet.

The leading builders and architects, both East and West, have given it, as their opinion, that the present rates of wages, and the steadiness of employment connected with reasonable prospects of labor, and an improving tendency will unite to prevent any interference with the natural course of building enterprise.

The industrial conditions throughout the country are all favorable, even though temporary causes are unsettling their city products. The Inter-State Commerce Law is credited with a vast amount of disturbance, and in many sections of the country it is claimed that it is doing harm to the producing and shipping interests; but these opinions are the result of a scant acquaintance with its operations.

Our railroad managers are sincere believers in the efficency of its legislation to produce the desired results. They are at least giving their best efforts in putting its provisions into operation. Throughout Pennsylvania iron and steel makers are complaining of unjust rates, while the lumber interests of New York and Pennsylvania are recognizing that the long-haul clause is likely to work to their advantage.

The Northwestern lumber interests are relying upon the legitimate demand for lumber, and have provisions for white pine, over other kinds, as well as their advantages in shipping such a large percentage by water to maintain their hold upon the markets of the country.

The manufacturing interests will suffer for some little time, and the defects of the law, whatever they may be, will soon be singled out one by one, and, if necessary, become the subject of supplementary legislation. Advices from over twenty large cities throughout the West and South show that the actual conditions are better than they appear on the surface. The consumption of materials of all kinds is heavy and increasing, and the push of new enterprises is not interfered with in the least by freight-rates or temporary dulness. The plans made during the winter for the enlargement of the industrial capacity are being pushed with zeal, and it is probable that nothing will interfere with the carrying out of these plans.

The iron trade is reported dull, but this is misleading. At no time has the production of iron or steel been as heavy as at present. The total crude iron capacity of the country is only a trifle under twenty thousand tons. The production of steel rails is not far from forty thousand tons per week. The output of structural iron for bridge and building purposes has been materially increased within the past six months, and an enlargement of capacity is contemplated. In fact, an extension of the iron-making capacity in all directions is going on, and the most industrious gatherer of iron-trade statistics fails to keep pace with the real progress of that great industry.

The producers of coal, both here and South, are complaining in trade channels of dulness, but the figures of production show an increase this year over last year, and of consumption varying from ten to fifteen per cent greater.

The details as to the lumber trade show that an extraordinary activity prevails in all leading markets. Mills, in various sections of the South, are running day and night, and the demand for lumber is reaching to remote markets. Southern lumber is finding its way into the North, East and Southwest, while white pine is scattered throughout the entire region west of the Mississippi, and is the staple lumber in New England. These enlarging markets are helping to keep stocks well depleted, and quotations high and firm. Some general cause, namely, the widening market for our staple products, is the reason for the firm prices maintained in all the leading industries, against the predictions of pessimists, and are fearing that the extraordinary increase in producing capacity is bringing us by inches nearer and nearer to an industrial collapse. It is this unreasonable apprehension that is leading to the heavy importation of foreign products, and which is not responsible for the relative scarcity of supplies, and the correspondingly high prices. The mistake to the extent that a mistake has been made by over-conservatism, will be safely remedied this year by a revival of competition, as the result of the extraordinary expansion of productive capacity in every industry known to the American laborer. The railroad-buyers have begun work in earnest, and from now until midsummer the greatest activity will be displayed, unless here and there a few halting syndicates will take an alarm and wait. The great bulk of building will be prosecuted. Bridge-building will be very active, and within the next four months as much bridge work will be put into position as was constructed during all of last year. Our advices from architects throughout the Middle and the Western States are confirmatory of recent advices from the same sources, and show that a large amount of building of a heavier sort, such as banks, churches, warehouses, school-houses, and buildings of the like, will engage the attention of architects and builders this year. The usual multitude of small houses will be built, and the activity in this direction will not be confined, as heretofore, to the larger cities, but will extend into the smaller cities and towns where it is learned, especially in the West, that extensive arrangements have been consummated for the erection of dwellings that will rent for from $6 to $20 per month.

This class of houses seems to be growing in favor with local investors, identified with industrial enterprises. Hundreds of manufacturers are wisely considering the propriety of investing money in comfortable tenements for employés, which will yield an income, in the case of a depression, which will narrow their shop, mill, and factory margins.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, by TICKNOR & COMPANY, Boston, Mass. No. 591.

APRIL 23, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

A CURIOUS application of the methods of the Knights of Labor has been made in Pennsylvania within a few days. It seems that the officers of one of the most important railroads in the State discovered, not long ago, that the road was being systematically robbed by the employés, who broke open or unlocked freight cars in the night, and carried off thousands of dollars' worth of property at a time. On setting detectives at work to discover the perpetrators of these thefts, it was ascertained that there were hundreds of persons concerned; and the railway officials, learning that the arrest of all those against whom proof had been found would leave them without conductors and brakemen enough to run their trains, contented themselves with making a beginning by arresting about a hundred of those who could be most easily spared or replaced. No doubt they would have gone on to bring the others to justice, but for a rather startling move on the part of the brakemen and conductors still out of jail, who held a secret meeting, as the result of which they informed the officers of the road that unless a guaranty was immediately given that no more arrests should be made, and a certificate issued to the effect that all the employés of the road still at large were innocent of crime, a strike would be ordered, and the trains in movement on the line would be at a given signal switched off on side tracks and abandoned, leaving the passengers in them to their fate. As this course would bring loss and suffering to thousands of helpless passengers, besides enormous expense to the company in the way of damages, the conspirators undoubtedly foresaw that the directors would think twice before rejecting their proposition, even if they did not conclude to accept it. As a matter of right and wrong, there seems to be no reason why such a scheme on the part of a gang of known or suspected thieves, who happen to be in a position to distress other people, for keeping themselves out of prison by threats of wholesale vengeance on those in their power, is any worse than the regular proceedings of the Knights of Labor for monopolizing the means of living; but the probability that a large part of the travelling public, as well as of the business men of the country, may be affected, instead of a few poor mechanics, lends the matter a special interest. So far as the community is concerned, the attempt to use its distress to coerce a party to a quarrel in which it has no part is simply highway robbery, and should be punished accordingly. As every one knows, a crew of sailors who should take possession of a ship, and hold it until they had exacted from the captain compliance with some demand, would be hung as pirates at the first port at which they touched afterward; and the land pirates who presume to seize upon the channels of public communication for their own purposes should be dealt with in a similar manner. Many years ago, when governors and expectant governors scorned to dance at the heels of "colossal organizations," the employés of a New-York railroad undertook to prevent the running of trains until some demand of theirs should be granted. The moment the news of this invasion of public rights was received, Governor Hoffman, a man as popular as he was able and courageous, took military possession of the road, and trains, guarded by bayonets, were run on schedule time until the Governor thought it safe to hand back the road to the directors of the company.

MR. JOHN WANAMAKER, of Philadelphia, has recently announced that henceforth the persons employed in his store, some thirty-five hundred in number, will participate in the profits of the business, under a rule which provides that every one who has been in his service for seven years or more shall receive each year a dividend proportionate to the value of his or her services during the preceding twelve months. This value is to be reckoned, not alone by the amount of salary paid, as is usually done in such cases, but by the faithfulness and industry of each, as shown by the records of sales credited to the different employés, or other work done. Mr. Wanamaker himself proposes to be the judge of the merit of each person, but this is almost a matter of course, and the introduction of an element of emulation among the employés, by which those placed by circumstances in a humble position may be sure that faithful service in that position will be recognized and rewarded, is certainly of great importance. The total amount to be taken from the profits and divided annually will be not less than one hundred thousand dollars, all of which is to be taken from Mr. Wanamaker's private share of the receipts of the firm's business. Supposing that half the employés are entitled to participate in this the first year, the dividend will average nearly sixty dollars for each, a very pretty reward of merit, particularly when accompanied with a prospect of its annual repetition. Participation schemes of this kind are getting to be so common that this is only particularly remarkable for the great number of persons to be benefited by it, and perhaps also for being one of the first applications of the principle to a large retail business; but its announcement in Pennsylvania, the home of the head of the "colossal organization" of the Knights of Labor, leads one to reflect that the future may have trouble in store for the Wanamaker clerks and shop-girls. According to Mr. Powderly, it is "a great gain" to prevent money from getting into the pocket of an employer of labor, by any means, fair or foul, whether any of the money kept out of his pocket goes into that of other persons or not, and as a good deal of money annually goes into Mr. Wanamaker's pocket, it would evidently be a highly meritorious act, according to this view, to "boycott" his store, or scare his customers away with dynamite, or in some other way reduce the profits of his business to those of one managed by a lazy blackleg. Under the new arrangement there would be a difficulty in the carrying-out of a plan of this kind for elevating labor at the expense of monopoly, owing to the fact that the cutting down of Mr. Wanamaker's income would also cut down that of several hundred poor people who shared in his profits. It is true that a poor person who does not belong to the "colossal organization" is quite as legitimate a victim of its schemes as a monopolist, and usually a much less troublesome one, but two or three thousand people attacked at once, even by a "colossal organization," would be likely, before they succumbed, to make outcry enough to attract the attention of the community; and although the Knights of Labor, as we are told, "will not stand much nonsense," the rest of the world, it may some time be found, will not stand much more tyrannizing by self-constituted organizations over poor and helpless people who ask nothing more than the privilege of being allowed to work for their living.

FIRE AND WATER has for some time expressed doubts as to the value of the indiscriminate use of automatic sprinklers, which are just now quite popular with real-estate owners. As it says, with its usual good sense, while sprinklers in factories are an invaluable protection, acting instantly, where nothing but immediate action is of much avail, and rarely doing any incidental harm beyond the wetting of a few pieces of goods, the same sprinklers in a city store, if brought into action by a fire which the watchman could, in such a place, easily extinguish, might destroy many thousands of dollars' worth of property in a few seconds. It is rather remarkable that a few days after its noticeable editorial on the subject appeared, its wisdom was illustrated by the occurrence of a fire, in which almost the only damage done was by the sprinklers, which ruined more than thirty thousand dollars' worth of goods before the people who came to extinguish the slight fire which

set them in operation could get the water turned off; and the more intelligent insurance men are beginning to doubt whether they should be recommended without discretion. Some of the most recent sprinklers, to avoid the objection to those acting automatically, are arranged on the "dry-pipe" plan, by which the raising of the temperature in a given room sounds an alarm, either outside or inside the building, in some place where sets of valves are provided, under the care of a watchman, by which water can be let into the sprinklers of any room. This method has yet to be proved. Under cool management, and with close attention, the control of the valves must be valuable; but an inattentive, or, still worse, a panicky watchman, might do more harm with them than could be accomplished under the most defective of the old sprinkler systems.

THE Monthyon prize for improvement in mechanical arts which involve unwholesome conditions for the workmen, has this year been awarded to MM. Appert, glass-workers at Clichy, for the successful substitution of compressed air for the effort of the lungs in glass-blowing. Until the present time nearly every article of glass, excepting plate-glass and a few objects pressed in moulds, is fashioned into form by the workman's breath. With small pieces the blowing is not a difficult matter, but with large ones, such as the huge cylinders which, split while hot by the touch of an iron bar, unfold into sheets of window-glass five or six feet long, a very violent and sustained effort is necessary, which is within the power only of the strongest men, and even in them often produces serious injury. Various devices are already in use for helping the work, such, for instance, as the dropping of alcohol through the blowing-tubes into the hot sheet-glass cylinders, to assist by its vaporization and expansion the effect of the breath; or the little air-pump, which, invented by an old workman to supplement his failing powers, now finds a place in every manufactory; but the general substitution of air under mechanical pressure for the breath expelled from the lungs by muscular effort had never been successfully made before MM. Appert solved the problem. The principle having been long understood, the merit of the new appliance consists mainly in the details by which, from a reservoir of air, compressed by a powerful pump, portions can be taken at any desired pressure and transmitted to the melted glass through a tube which the workman can swing around his head, roll on a slab, or twist or turn in any desired direction, with a freedom as great as that with which he twirls a tube after applying it to his mouth. The valves for supplying air to the blow-pipe are set in the floor, so that the workman can operate them with his foot; and, according to the *Revue Industrielle*, the advantages which the process offers are so great that, notwithstanding the ignorant opposition of workmen, several large establishments have already followed MM. Appert in adopting it.

IT is well worth while for architects to remember that the art of decorative mosaic, particularly in its application to church buildings, has recently received a considerable impulse by the opening of an establishment in Venice, where particular attention is to be paid to the simplification of processes, in such a way as to bring the cost of the work within the means of small churches and private persons. The idea of founding such an establishment seems to have been suggested by a resolution of the Catholic Congress of Modena in 1879, which expressed the wish that such a splendid and unalterable form of decoration might be made more generally available by lowering its price and extending its use; and the charitable ingenuity of two Venetian ladies, who were anxious to find occupation for some highly-trained young girls in whom they were interested, furnished another factor in the enterprise. With the help of Dr. Saccardo, the director of the mosaic workshop connected with the church of Saint Mark, and of Professor Raffaelle Cattaneo, the architect of the great monument to Pope Pius Ninth, at Rome, and under the special encouragement of the present Pope and the Cardinal of Venice, a small corps of skilled workmen was engaged, the ladies Silvestri furnished a building, the ancient Palazzo Sceriman, near the church of Santi Apostoli, of which they were the owners, together with the coöperation of their protegés, and the enterprise was fairly launched. The first important commission with which the new establishment was entrusted was the mosaic work for the monument of Pius Ninth, but other orders came in, and twenty young ladies are now constantly employed in designing all kinds of mosaic, from the decoration of a lamp to that of a church dome, which is executed by a proportionate number of workmen. Although church decoration is the most important part of the business, domestic decoration, in any sort of mosaic, is undertaken. The work is sent to any distance, made up into sections of convenient size; and those who wish for anything of the kind may, as we are assured on the best authority, have it well and cheaply done, and at the same time do a kindness to poor young girls, by applying or writing directly to Madame Elena Silvestri, Sceriman Palace, Santi Apostoli, Venice.

AN odd and rather startling form of draw bridge is described and illustrated in *Le Génie Civil* of a recent date. Between the important maritime town of Saint-Malo and the suburb of Saint-Servan is a channel, which forms part of the port, so that it is not allowable to interrupt it by a bridge, and even a draw-bridge of the ordinary type would be very much in the way. Ferry-boats would not obstruct navigation; but no one likes ferry-boat sailing if he can reach his destination in any other way, and an architect of Saint-Servan, M. Leroyer, devised a combination, as we may say, of ferry-boat and bridge, uniting the advantages of both. The tide rises to a great height at Saint-Malo, the difference between high and low water being often as much as thirty or forty feet, and at low tide a track was laid across the bed of the channel, resting on sleepers sunk in the mud. A platform was then constructed, resting on a trestle-work about forty feet high, the foot of which was furnished with wheels, rolling on the track at the bottom of the channel. Ropes were laid along the bottom, attached to the rolling platform, and running over pulleys at each shore-end. Piers were then built, after the fashion of ferry-slips, so as to embrace the platform at each end of its trip, and hold it firmly, and the platform-ferry was ready for service. A small awning is spread over the central portion of the platform, and those who sit there pay an extra price, ordinary passengers paying only one cent, but being exposed to the weather. The platform will accommodate rather more than one hundred passengers, and carriages and cattle can be transported on occasion. When all is ready, the platform launches forth, drawn by a windlass acting on the ropes, and in ninety seconds is at the opposite shore. Although there are no guides or other means of steering the apparatus except the ropes at the bottom, and it has a very top-heavy appearance, it is found to move with perfect steadiness and precision either at high or low tide, although the current runs at half-tide at the rate of more than six miles an hour; and even in weather when vessels dared not leave their anchorage, no inconvenience has been experienced by the bridge-passengers, nor has any accident of any sort occurred during the sixteen years that the bridge has been in use.

THE *Revue Industrielle* gives a very curious account of some experiments recently made at Pantin, near Paris, by M. Charles Weyher, one of the directors of a mechanical laboratory there. A jet of air or steam was directed at an angle of forty-five degrees with the horizon, and two light spheres, one of cork and the other of India-rubber inflated with air, were thrown into it. Both the spheres, although heavier than air, were kept suspended in space by the jet, which at the same time communicated to them a rotary motion. The rotary motion, it was found, was only indirectly concerned in keeping the spheres suspended, the effect being mainly caused by the little whirlwinds, a series of which was set in motion by the jet. On placing the hand in the jet, beyond the spheres, the course of the little whirlwinds was disturbed, and the spheres approached nearer to the nozzle, from which the jet issued. If the lighter sphere, that filled with air, was placed originally farther from the nozzle than the other, it would retain that relative position; but placing the hand in the jet beyond, it would cause it to approach more nearly to the other. In a second experiment, a globe formed of overlapping strips was mounted on a spindle in the line of the jet. The current appeared to be absorbed by the hollow globe, and given out again at its equator, where a centrifugal current was felt, so strong as to throw bits of paper presented to it forcibly away. Nevertheless, this centrifugal current had a definite orbital form, as it seemed, for when a light inflated globe was placed near, it was at first repelled, and then attracted, finally taking up a motion of rotation about the primary globe, in the plane of its equator, and if a disk of paper, with a hole in the centre, rather larger than the outside diameter of the globe, were let fall near it, the paper was instantly taken up by the current, and brought into a position encircling the globe, at the equator, and there maintained indefinitely.

PICTURES OF THE SEASON IN NEW YORK.[1]—III.



CERTAINLY the spring art-season has opened in an auspicious way. The Stewart sale did not show so reckless a throwing about of money, so unbalanced and over-wrought an enthusiasm as the Morgan sale of last year. Mr. Cornelius Vanderbilt purchased from it for the Metropolitan Museum the best picture the collection held for such a purpose — Rosa Bonheur's "Horse Fair." Mr. Seney, of Brooklyn, has since given to the same institution ten American and foreign pictures, some of them of the highest value; and now the bequest of Miss Catherine Wolfe has followed — two hundred fine foreign paintings and water-colors, and $200,000 as a fund to keep these pictures in proper order, and to add others to their number in future years. And finally the Academy exhibition has revealed a so much better spirit than usual on the part of its managers, and a so much better collection of pictures than usual, that its opening was greeted with a unanimous chorus of praise. If, now, some one would only purchase the Rembrandt portrait for the Museum, our cup of gratitude would be full!

Chief in renown among the Seney pictures is Le Rolle's large "Organ Rehearsal." It was exhibited last spring with the "Impressionist" pictures, though it had no slightest affinity with the rest of the collection. It was then recognized as one of the strongest, soberest and most accomplished works which had come to us from the younger generation of French artists — one in which "effectiveness" had not been striven for either in theme or in execution, but which was extremely effective none the less; one which was most admirable alike in drawing, in composition, in color and in feeling; one which had a distinctly "modern" accent, and not the least touch of eccentricity; one, therefore, which was instructive and inspiring in the best possible way, and not interesting and delightful merely. A fine example of Israels is also among Mr. Seney's gifts, and two small landscapes by Anton Mauve; also a superb George Innes — perhaps more welcome to good Americans and to lovers of the poetical as well as of the accomplished in art than any of the others; Mr. Millet's excellent *genre* called the "Cosy Corner"; and the most important of those charming landscapes which Mr. Charles Davis recently exhibited at the Reichard gallery.

All these pictures and the "Horse Fair" will be shown when the Museum opens after its coming spring re-arrangement. The Wolfe pictures we shall not see until the new wing of the Museum is complete, and a special apartment is prepared for them in accordance with Miss Wolfe's natural request. They will be found to include many modern French and a few German pictures, some of the highest artistic quality, and others of a more "popular" sort, but all, if I remember them aright, distinctly good examples of their respective painters. Knaus's "Holy Family" and Gabriel Max's "Greeting" are the best known of the second sort; and of the first sort I may name Meissonier's "Two Vanderneers," which is as fine a work of his as has ever come to this country, and in certain respects — notably in color — perhaps the very finest; and Jules Bréton's "Penitents," — a long line of peasants bearing tapers and passing down a narrow, steep, village street. In dramatic force and in execution this is a superb example— far superior to most of the canvases Bréton paints to-day. Gérôme's "Prayer in the Mosque" is another work familiar through engravings; and the collection also includes good examples of Decamps, Robert-Fleury, Cot, Kaulbach, Isabey, Alfred Stevens, and a long and varied list of equally well-known painters. Until now the Museum has scarcely had enough good modern pictures to be called even the nucleus of a good collection. But now, within a single month, it has been placed upon a par with all but the very best of our private galleries. With the exception of Mr. Vanderbilt's pictures, and of Mr. Erwin Davis's, I know of no other New York collection which, as a whole, the city could have been so glad to own as Miss Wolfe's.

It must be a new sensation to our National Academicians to find nothing but praise of themselves and their exhibition in the current pages of the press. But they need feel no false modesty in accepting it. They have deserved praise this year as much as they have sometimes deserved blame in the past — and praise for good performance as well as for good intentions. Their committee-on-selections was wisely chosen, and was instructed or allowed to aim at forming an excellent rather than a big collection. Never before was such a vigorous weeding-out seen within these walls — more than one supposed flower from actual Academic stems having, it is said, been thrown aside with those of less distinguished origin. Then the hanging-committee proved equally judicious. And as a result we have rooms which are comfortably filled but not crowded — no pictures scraping the sky-line or standing about the wainscot, and all being grouped in a way which, as a rule, gives the better pictures the better places, and which avoids as far as possible destructive juxtaposition. There is hardly a single picture in the collection which has not at least some small degree of merit — hardly one that is utterly futile, hideous or ludicrous. To say this only would be to say much by contrast with what we have been obliged to say in former years. But even more than this can be said. The average is better than one might have expected with two more large general exhibitions in immediate prospect, and the proportion of really good things is greater. And a few examples stand out above the others as pronounced, individual and most interesting successes. Chief among these are two paintings and — strange fact — one statue of heroic size.

Mr. Winslow Homer has painted on a moderate but effective scale an animated life-saving scene — two brawny, half-nude surfmen dragging to shore two unconscious, youthful bathers. The four figures form a magnificent almost frieze-like line — the surfmen erect and holding their rope on either side, and the bathers locked in each others arms in the centre, — all relieved against the blue-green mass of a great curling breaker. Such power combined with such grace in composition and line is a very rare quality in modern art; and its expression in art which is "realistic" in mood and "local" in its choice of theme is rarer still. But there is no modern artist who thinks more than Mr. Homer of absolute truth to nature — not even any among the French Impressionists; none who cares more than he for "representative" local themes; none who expresses life, action, character more forcibly; none who better knows the difference between true pictorial and pseudo-sculpturesque design; — and yet none whose work has a more marked degree of linear grandeur. And I know of none other who so combines all these qualities in his art. A most valuable lesson is therefore afforded by this art — the lesson that realism need not mean the death of *pictorial* idealism, truth need not mean ugliness, local themes need not mean the exclusion of grace of form, any more than the exclusion of charm of color. The coloring of this picture — which, by the way, is called "Undertow" — reminds one not a little of certain schemes one saw in the Impressionist collection; which is merely to say, of course, that when men really study out-door effects with a really fresh and open eye, their interpretations of it will often have much in common. It is a very bold scheme, the strong tints of the water being given without palliation, and its blue reflections on the wet flesh being recorded with extreme frankness. But seen at the proper distance it seems as truthful as it unquestionably is, and though a trifle crude, perhaps, is not harsh or cold, or in any way unpleasing. Had not our eyes been emasculated by a long course of studio-painting of similar effects, we should certainly not hesitate to call it very delightful as well as very impressive color.

Mr. Dewing's picture called "Days" is at the very opposite extreme of art. Interpreting Emerson's familiar little poem, it is of course idealistic, and not realistic painting. And its soft and tender color-scheme, and its accomplished and beautiful but somewhat vaporous handling exclude the possibility of any direct reference to natural, *plein air* effects. Its figures are beautifully grouped and finely expressive; and despite its literary inspiration it is not an illustration or a bit of painted literature but a true picture, well able to stand on its own intrinsic merits. Far from trying to contrast two such works as these, and to decide which of them is "better,"

[1] Continued from No. 587, page 150.

the student may well dwell for instruction upon their difference, learn therefrom how wide is the range of the painter's art, and learn too what is meant by a good result in each direction.

The statue to which I have referred is by Mr. John Donoghue, a young artist from Chicago who has studied in Paris and since worked in Rome, and who has recently returned to this country. It is in plaster, and designed for marble, and represents the youthful Sophocles leading the chorus of victory after the battle of Salamis. Here again, of course, is an ideal work; but its subject is such that it gave a chance for the most vigorous treatment and the strongest portrayal of emotion. The figure is that of a very young man — Sophocles at this time, I believe, was but sixteen — and is consequently thin. The light where it now stands exaggerates its thinness, strongly accenting the shadows on the torso; but seen in a discreeter illumination, I think it would be as pleasing as it now is vigorous. The youth — who is nude, save for his sandals — is represented in motion and in the act of singing. He has just taken a step towards the right, and rests upon his right leg, with the left extended, just touching the ground. His lyre rests high on his left shoulder — a lyre formed, according to tradition, of the shell of a tortoise and the horns of a ram; his head is turned partially towards it, and his right arm is raised and extended as having just struck the strings. The action is extremely well chosen, it seems to me, for it immediately explains itself to the dullest eye, and despite its vigor it has grace and repose; and the expression of the head is equally good. The face is classically, regularly beautiful, but individual and impressive; and though the mouth is half-open it does not unduly disturb that serenity which sculptured work always should preserve. It is rare indeed that we see in modern work — at least in this part of the world — so much beauty and sculptural *rightness* combined with so much expression — the mood rendered being naturally that of enthusiasm, inspiration, that of a young artist possessed by the combined influence of his art, of his patriotism, and of the inevitable pride resulting from his selection as the most beautiful young man of Greece. This expression is as well conceived and as distinctly rendered, I think, as the action of the body; and saying this I know I have said what will seem a great deal for a statue by a hitherto unknown hand. Technically I do not presume either to praise or to criticise the work. Perhaps it is very good in this way — perhaps it may have many faults to instructed eyes. All I can pretend to say is that it impresses even an uninstructed eye as interesting and *vital* — that it not only charms the sense of sight, but wakes a definite, strong, pleasureable and new emotion. And this proves, I think, that the artist has the root of the matter in him. Even though this statue may have faults — I have no reason to suppose it has, save the thought that I could not detect them were they present — it surely promises a future for its author if he continues in coming years to be as serious a student and as true an artist as he must have been in the past.

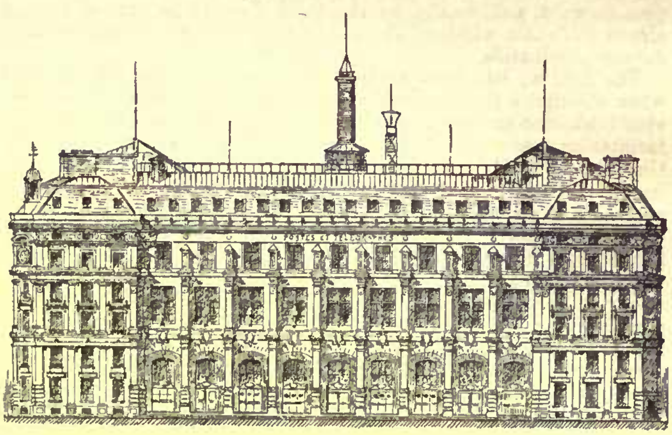
Minor works of sculpture in the exhibition also afford much satisfaction, notably two portrait-heads, by Mr. Warner. The painted portraits are hardly as numerous as usual, and few among them are of great interest. Munkácsy is represented by two which are hardly more than sketches — as such technically very clever, but as pictures not very delightful. And Mr. Alden Weir has a delightful portrait of a little child, and Mr. Freer an attractive one of a lady in a black evening dress.

Landscapes are not so conspicuous this year as usual. There are few of large size or great importance but, on the other hand, very many modest works of considerable excellence. One of the best as well as largest is Mr. George Innes, Jr.'s cattle-piece, and another is Mr. Walter Palmer's winter scene. Mr. Homer Martin sends several little pictures which are marvellously charming and poetic.

Two or three battle-pictures show work in the right direction — in the direction of individualized as against mere scenic battle-painting — the best of them being Mr. de Thulstrup's. *Genres* are numerous, and on the average infinitely better than they used to be only a few years ago. One of the most individual is Mr. Mowbray's Japanesey little "Rose Festival," which shows a charming sense for color, a delightful freshness and grace in execution, and no small amount of feeling for character too. One of the strongest — indeed the very strongest — in character is Mr. Kappes's negro interior. It is a pity that this extremely clever, serious, diligent and in other respects well-balanced artist should let himself be so seduced by a desire for strong effects of light that his tints grow chalky, and his figures sometimes seem to swim in the atmosphere of a flour-mill. One of the poorer *genre*-pictures in the collection excites the strongest interest and admiration — not for what it is, but for what it might have been if some one else had painted it. The excellence of the themes that may be found in our prosaic modern surroundings is illustrated by this dusky barn-like interior where women in bright cotton frocks are plaiting yellow straw around great shining green-glass demijohns and bottles. Such a chance as it was for effects of light, effects of grouping, effects of opaque and translucent color! But the utterly ugly and uninteresting result illustrates the fact that after all it is the painter who makes the subject, not the subject which makes or ever possibly can make the painter.

M. G. van Rensselaer.

PARIS GOSSIP.



The New Hôtel des Postes.

I WOULD like to say a word or two about our new Hôtel des Postes, M. Guadet, architect, concerning which there is a great deal said here, and which unfortunately is criticised too much. The opening, which should have taken place in August, 1886, has not yet occurred. This delay, which has greatly inconvenienced the merchants who counted on the trade which must be brought into the quarter by the location there of the post-office, has finished by becoming a grievance to the public at large, who, relying unadvisedly on articles contained in journals of greater or less credibility, have laid upon M. Guadet the responsibility for these delays. They have even gone so far as to pretend that the Hôtel des Postes, absolutely unfit for its intended service, was going to be sold to a great dry-goods house; that it was badly conceived, badly lighted, and in every way insufficient; that its height, which obliged the letters to rise and descend, was highly defective in the sense that it was the cause of a loss of time, etc.; this ought to have been done, that ought to have been done, the other ought to have been tried; in short, everybody gave his advice, and criticised, without, I believe, knowing a single word of the merits of the question. And it must be confessed that through being forced to read or listen to one thing, people finished by asking themselves if the thing was not true.

I desired to inform myself of the real truth of all these rumors. I visited the building, and I left it absolutely convinced that it answers perfectly the service that is expected of it.

I will, if you are willing, examine the particular criticisms which have been directed at this unfortunate building, and reply to them. "A post-office ought, to assure prompt service, to be flush with the sidewalk." In the first place, is this assertion supportable? Is it really shorter to make the mail-bags travel over a horizontal distance than to raise them by means of an elevator to the height of two or three stories, whence they descend rapidly by inclined chutes? For my part I do not believe it. The elevators employed are formed of platforms one above another, which always remain horizontal and parallel, even at the upper and lower points. At each story stops, at the same time every six seconds, a platform to receive the letter-pouches; altogether, they can raise 120,000 kilogrammes per hour, and run from the sub-basement to the roof. As to the descent, it is effected in a few seconds over inclined planes arranged in spirals. Rapidity of service is thus obtained in a perfectly satisfactory manner. Next, could there be found in the very centre of Paris a site of 30,000 metres (the floor area which is actually occupied by the different branches of the post-office), and, admitting that it could be found, at what price could it be obtained? The expropriations have cost 1,800 francs per metre. If the inhabitants of an entire quarter had been obliged to move, could the property have been acquired at any such price as this? M. Guadet maintains that expropriation under these conditions would have cost about 2,000 francs a metre, which gives for a surface of 30,000 metres the respectable sum of 60,000,000. Now they have actually spent 14,-000,000, which shows a saving of 45,000,000 at least. It seems to me that this was quite worth while. As to the cost of the building, it is plain that to roof 30,000 metres on one floor would have cost somewhat more than to roof several superposed floors of 7,500 metres each. Let us now pass to the next criticism, which can only be refuted by examining the building. "The post-office is badly lighted!" This criticism can only be brought forward by persons who have not seen it, or who, during their visit, wore colored glasses. All the rooms front either on the façade or upon interior courts sufficiently large and spacious; but to tell the truth, the rooms lighted from glass-roofed court-yards are at the moment somewhat dark, because the windows have not been washed, and the dust, the removal of which awaits the inauguration of the building, has accumulated on them; but let these people who do not desire to see clearly stop and think a moment. One does not see clearly! In heaven's name, when the blinds of a window are closed does one see clearly in a room? Wait until they are opened. Finally, "the Hôtel de Postes is too small." For this the same answer. Go, look for yourself, and you will discover that not only is it sufficiently large, but that provision for a large increase in the working force has also been made. Upon the first floor, where the distribution of the letters for Paris is made, there is a considerable space which is not occupied. The same can

be said for the second floor, where the sorting of provincial letters goes forward, and, finally, on the third floor, large halls occupying almost the whole width of the building are for the moment without definite destination.

The lighting has been studied, and provision made for the time when electricity shall entirely replace gas. Everywhere during my visit I detected an endeavor to discover the most practical means for facilitating the work of the post-office, and I can affirm that M. Guadet is perfectly blameless for the delays which prevent the opening of the building. Nevertheless, there must be a reason. Alas, yes; and this reason we shall find in the elevators, which are not working in a perfectly satisfactory manner. There is in the mechanism of these elevators a wretched cast-steel crown, with helicoidal teeth, which is at the bottom of all the trouble. It ought to be very strong and not wear out. Germany could certainly furnish us with these pieces, perfectly satisfactory in every way, but the Government wished to address itself exclusively to French ironworks, which are unfortunately imperfectly equipped for this kind of work. There have been experiments: several pieces could not be used, and it was necessary to begin all over again; and as perfection of working is indispensable, there have been delays, and this is all there is about it. But add to these mishaps the bad humor of all those who suffer perforce by this delay, the discontent of the employés of the post-office itself — who are, perhaps, not very well satisfied with the new arrangement, which makes them work in front of and not behind those partitions and gratings, which used to allow them to breakfast or read at their leisure, while the public wearied itself on the other side — and you will have in these things the explanation of all the false rumors, the prejudiced criticisms, and the fantastic explanations which have caused so much ink to flow. So much for the inside. As for the outside, I confess that I do not greatly admire the façades. Here is to be found a regrettable heaviness and details badly studied; but as space is limited, I prefer not to dally over a criticism which may, after all, not be shared by others, and which is merely a matter of taste.

We had, not long ago, a very interesting exhibition at the Gal-Gallery Georges Petit. It was the exhibition of the sketches, drawings and studies of M. Toché, a young artist charged with the decoration of the Château de Chenonceaux, and particularly of the large ball-room. What constituted the interest in this exhibition was that M. Toché had made all his studies in water-color, and of proportions unknown in this medium, which is ordinarily reserved for what is fine and delicate. M. Toché handles water-colors as the great masters handled oils. He makes you a decorative composition, life-size, with vines and light which are really incredible; draped figures, nude figures, draperies, vases of flowers, garlands, everything, all in water-color. What *brio!* what color! what ability! Here is a *virtuoso* in water-colors. M. Toché joins to this a very perfect draughtsmanship. There were studies of charming ceilings, of decorative panels, and some travelling sketches. His draperies in water-color had the texture and plushiness of oils. What intensity in his tones! What sparkling play in his lights! An ass harnessed to a cart loaded with three peasants is absolutely lifelike. The air palpitates, the ass pricks up his ears, his hide is covered with real hairs, and at the least movement of the animal the cart-wheel will turn. It is charming, and what simplicity of rendering! I like less the nude figures, of which the modelling in water-color is a little brutal, and the flesh-colors are a little too uniformly on the bistre, the yellow or the gray, or finally become chalky. But that is neither here nor there. This exhibition has been a revelation of a real and a very original talent, and evidences in M. Toché the temperament of an artist and decorator. While visiting this gallery, I look back on the exhibition, a few months ago, of the competitive drawings for the decorative paintings for the marie at Pantin, in the environs of Paris. I was at that time astonished by the poverty of the works submitted. No original ideas, no drawing, no imagination, and an unfortunate tendency, as I look at things, when it is a matter of decoration, to modernize the subject. The majority of the competitors had sought modern scenes, reviews of troops, groups of school-boys, national fêtes, with flags, illuminations and fire-works; everything was shrill and blustering, a perfect orgie of glaring colors. It was horrible! And what sort of decorative effect could be produced with these modern crowds, these men in blouses, these street boys of Paris? These modern fashions, will certainly change just as have the preceding fashions, and can consequently only become caricatures. Such a subject could only pass muster by reason of the ability of the composition and the talent shown in the rendering; but there was nothing of the sort. Nevertheless, there were happily, by way of relief, some good conceptions, and it must be said that the most seductive designs and the most suited to decorative purpose had for their subjects allegorical scenes, or at least scenes from early days. MM. François Lafon, Schommer (with a patriotic subject, the "Defense of Pantin," by Gen. Compaur in 1814, very well treated and showing real talent) and Henri Lévy, whose pieces were premiated, made themselves particularly remarked, as also MM. Hervy and Michel Lançon. It is M. Schommer who, as the result of the second step of the competition, has just been classed first and awarded the execution of the work, which will cost about 36,000 francs.

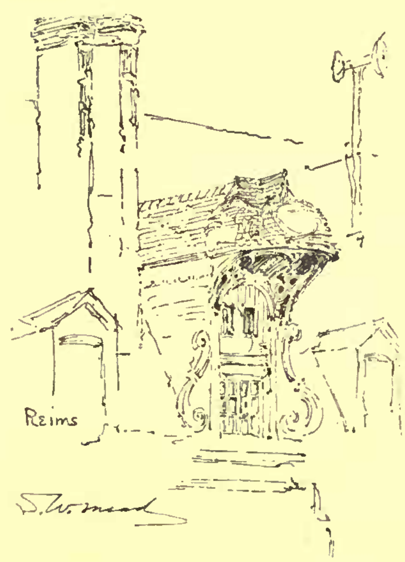
The annual exhibition of the water-colorists has opened lately. It is charming. The water-colorists, who were not long ago a mere handful, are now very numerous, and the exhibition counts three hundred and twenty-four numbers. All are interesting and worthy of being mentioned; but I wish to speak particularly of those which are treated purely in water-color, without body-color. There are, to be sure, some pretty things rendered with the aid of body-color; but I cannot avoid being far more impressed by real water-colors; and here in the first line I place Madame Madeleine Lemaire, with her admirable flowers and fruits. Some raspberries are marvellous in their freshness and transparency. They offer a chance to say with truthfulness that one "could eat them." Harpignies exhibits some charming landscapes and views of Paris; Dubufe fils, some seductive dancers surrounding a morsel of ballet music in a very original fashion, and a Marguerite and Faust; Maurice Leloir some graceful subjects for fans, etc. I perceive that it will be necessary to mention all, for in every one there is talent and attractiveness — Lami, Isabey, François, Jeanniot, Marand, Escalier, Pujol, Ducz, Détaille. There are others, also — M. Besnard, who, according to some, has a great deal of talent and is an original artist. I agree to this last expression, for original he is. As to his talent, I cannot understand a word of it.

There were pitiable exhibitions in the two galleries of the Place Vendome and Rue Volney. Here it is always the same thing, and all you can distinguish are Carolus Duran, Henner, Bonnat, Lefebvre, and some other leaders, without whom these little exhibitions would have no being.

I should like to say a few words on the works for the Exhibition and the new Station of St. Lazare, but I have already gossiped enough, and will postpone these two subjects, which are still sufficiently new, to another time.

M. Brincourt.

THE DESTRUCTION OF HOUSE REFUSE.[1]



The disposal of dead animals, garbage, dust and ashes not suitable for the sewers, and difficult to get rid of by dumping, is a matter which, so far as I know, has been handled with us in the crudest manner, and the same is true, generally, of Europe.

In 1877, there was built at Leeds one of the so-called "garbage destructors"; and either shortly before or after, the same apparatus was put up at Heckmondwike, Blackburn, Bradford, Warrington and Derby in England, and at Kralingen, near Rotterdam, in Holland. The first destructor at Leeds was erected at Burmantofts, two miles from Leeds Town Hall, in a northeasterly direction, and the second at Armley Road, about one mile westerly of the same point. The destroying furnace is the Fryer Patent Destructor.

For a description of this I cannot do better than quote from Mr. Hewson's report of 1884: —

"The destructor (at Burmantoft) consists of ten compartments or cells (five back to back) formed of brickwork, lined with fire-bricks, and tied with iron rods; it occupies a space of thirty-six feet by twenty-four, and twelve feet in height, and is so arranged that there is one inclined road leading from the adjoining road up to a platform, against and higher than the top of the destructor, onto which the refuse is carted, and another inclined road leading from the same adjoining road down to the level of the firing-floor, by means of which the mortar, charcoal, old iron, etc., are carted away.

"Each of the cells is capable of destroying six tons of refuse in twenty-four hours, and consists of a sloping furnace with hearth and fire-grate covered in by a reverberatory arch of fire-brick, with one opening at the top for the admission of the refuse, and another opening at the side, near the top, for the gases to escape into the flue, and a furnace frame and doors for the withdrawal of the clinkers. The refuse, which is tipped onto the top cells, is pushed down the incline or throat with a long iron prong, and slides forward onto the sloping hearth, whence, when sufficiently dry, it is helped forward onto the fire-bars, where it burns somewhat fiercely, the fire-brick arch above concentrating the radiant heat upon it. The opening for the entry of refuse is divided from the opening for the exit of gases by a partition-wall with a bridge. These prevent the refuse, which is heaped up immediately below, from finding its way into the flue also. At intervals of about two and a half hours, the clinkers are withdrawn through the furnace doors, but the charge of refuse is maintained permanently at the top. The effect of this is that no doors are required, the charge keeping down all smoke. The result of the process is that everything is consumed, or converted either into clinkers or a fine ash. Every two cells are also provided with an opening

[1] Extract from a paper by W. Howard White, read before the American Society of Civil Engineers, and published in the *Journal* of the Society.

(with doors) for the introduction of infected mattresses, diseased meat, etc., onto the fire, where everything is readily consumed without causing a smell in the works.

"The gases from the furnaces on the way to the chimney-shaft pass through a multitubular boiler, six feet in diameter and ten feet in length, and make steam to drive a horizontal engine with twelve-inch cylinder and two-foot stroke, which works two mortar-mills with pans eight feet in diameter. In these the clinkers made in the destructor are mixed with lime and ground into an exceedingly strong mortar, which is readily sold at five shillings per ton. No fuel of any kind is required, the ashes mixed with the refuse being amply sufficient. The old tins and iron which have passed through the furnace are sold for old metal at from five to fifteen shillings per ton; but if collected and sold unburned, they fetch one pound per ton. This is on account of the solder value saved by non-burning.

"The clinker from the furnaces is twenty-five per cent, by weight, of the refuse consumed."

A carbonizer was formerly used for the special treatment of market refuse, with a view to converting it into a high grade manure; but as it was found that eighty per cent of the charcoal obtained is simple earth, and therefore of little value as manure, the carbonizer was discontinued, and the whole of the refuse is treated in the ordinary destructor.

The original chimney at Burmantoft was about eighty feet high. As complaints were received of the smells from it, a new one, one hundred and fifty feet high, has been built; and in order to mitigate the discharge of dust over the neighborhood, the horizontal flue has been given the shape shown in the section *C D*, in which the depressions on the sides are to catch the dust [the middle portion of the floor of the flue is raised about two feet above the floor of the depressions mentioned], which is removed weekly through doors at the end of each block of cells. Since the rearrangement, no nuisance of any kind is reported.

The Burmantoft destructor consumed during the year ending August 31, 1884, as follows:—

Rubbish	1,538 tons.
Ash-pit rubbish	23,207 "
Beds	45
Mattresses	96
Pigs	58
Cows	9
Sheep	9
Quarters of bad meat	4

This was the product of about one hundred thousand people. The cost was as follows:—

EXPENDITURE.

	£	s.	d.
To cost, £7,282 1*s*. 1*d*. Repayment of debt by equal annual instalments of principal and interest during sixty years, at 3½ per cent	291	17	9
" Labor for one year	585	1	0
" Lime	34	18	4
" Depreciation, at 2½ per cent, covering repairs	182	0	6
" Gas, water-rates, etc.	126	19	7
	£1,220	17	2

RECEIPTS.

	£	s.	d.
By Mortar	97	18	11
" Charcoal	20	9	6
" Scrap iron	14	15	11
Balance	1,087	12	10
	£1,220	17	2

The Armley destructor sold, for some reason or other, much more mortar, and therefore, while its total expenses were about the same, the net cost of operating was only £842 4*s*. 6*d*.

To compare the cost of running these destructors with that of the removal of refuse otherwise, I will take the case of New York, where the removal of rubbish, etc., after being delivered at the water-front, to deep water, where it is now dumped, costs from $75,000 to $200,000 annually for a population of about 1,500,000. As the cost in Leeds is about $50 per one thousand per annum, the same rate applied to New York would give $75,000 per annum. The circumstances in Leeds are, however, much more favorable than in New York, since the city has a thinly-settled suburb completely surrounding it, and the destructors can be placed on moderately expensive land not available in New York (the Armley destructor at Leeds is, however, somewhat central in position). The rate of interest in Leeds is about three-fourths of what would have to be paid here, and the cost of labor perhaps two-thirds.

Altogether, it seems safe to say that the annual cost per thousand of the population, including all expenses of wear and tear, interest, etc., should not be much, if any, more than double those at Leeds, or $100 per one thousand, viz., $150,000 per annum for New York, which leaves a margin for contingencies or profit of from $25,000 to $50,000.

When we have paid this we have absolutely destroyed all injurious elements in the rubbish, in the only way which the present state of science indorses as effectual, and we have avoided the nuisance caused by dumping the rubbish into the ocean nearly entirely, the ashes left after burning being a small and innocuous element.

It has been claimed that there is not enough fuel in the rubbish of New York to maintain the necessary fire, but this seems to need proof in view of the English experience. One reason alleged for this is the practice of the poorer population of washing the cinder out of the ashes and reburning it, letting the ashes and the finer cinder go into the sewers. If so, it is time that this practice was stopped, by attaching penalties to such washing, and by obliging the owners of tenements to provide dust and ash spouts, into which the ashes could be sifted instead of into the sewers.

IN this same connection we may mention the prolonged discussion in the House of Commons, on the bill introduced by the Vestry of Kensington, seeking for power to acquire land whereon to erect furnaces for the destruction of refuse, which, the *Sanitary World* says, has drawn so much attention to this means of dealing with dust-bin refuse, that it may be well to supply some particulars of what is proposed to be done in the case in question. Our readers will not need to be informed that the system of refuse destruction which the vestry wishes to introduce is by no means a new system, for it has long been in use; but the plan prepared by Mr. Weaver, the surveyor to the Kensington Vestry, is a new adaptation of it, with some important improvements.

Under the existing system at Kensington, part of the refuse is taken to a brick-field in Wood Lane, by Shepherd's Bush, just outside the parish boundary, and part is "barged" to the sea beyond the Nore. The former portion is screened, the grit or sand being then made into bricks and the residue burned in the open air. To get rid of that part of the refuse costs the Vestry about 3*d*. a ton; sending the refuse away in barges costs from 1*s*. to 2*s*. 6*d*. a ton. There being in Kensington parish some 37,000 loads of house refuse, and 24,000 loads of street refuse, in all 61,000 loads, to be annually collected and disposed of, the total cost, under the present system, is something like £25,000.

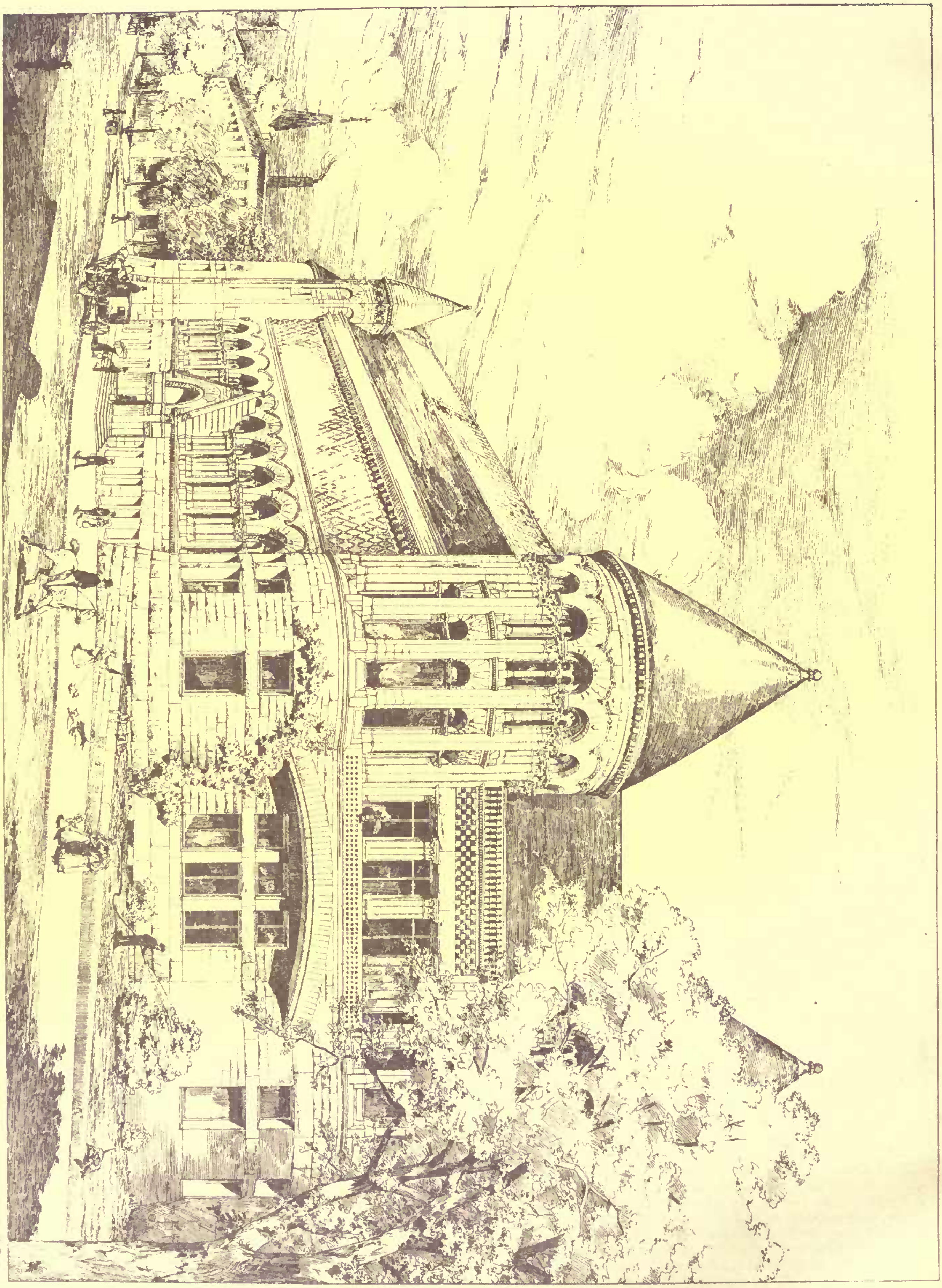
By the bill now before Parliament, the Vestry seeks powers to acquire about four acres of land at Notting Hill, for the purpose of forming a depot for the parish refuse and erecting appliances for treating it. The contents of the dust-bins will be cremated in a furnace of the type known as "Fryer's Destructor." This cremator, proposed to be erected, will consist of twenty cells or fireplaces with inclined hearths and reverberatory arches; the refuse being carried up an inclined roadway and delivered upon a floor about ten feet above the ground-level and immediately over the cells. Through openings or trap-doors coinciding in number with the cells, the refuse is shot and burned, the mass falling forward as the lower portion is consumed and reduced to clinkers, which are raked out at intervals. Each cell is capable of cremating six loads in twenty-four hours, the clinker residue being about equal in bulk to one-sixth of the unburned refuse. The clinker or slag it is proposed to use for road foundations and for grinding up into mortar. The flue from each cell emerges into one large common flue or chamber, where the united heat is about 1,200° Fahrenheit. The products of combustion are then passed into an extra cremator, formed a muffle chamber, where a clinker fire is kept burning, and by a series of arches the fumes are caught and reflected downwards several times into this clear clinker fire. From the muffle-chamber, where the heat is maintained at 1,800° Fahrenheit, the heated fumes pass onward and upward through a chimney-shaft 180 feet high. Certainly it is difficult to believe that any noxious thing would survive such an ordeal.

The road refuse is to be treated differently. On the same site Mr. Weaver proposes to erect extensive machinery for washing and screening the sweepings from the macadam and flint streets of the parish, the clean sand and grit thus obtainable being extremely valuable, the former for consolidating roads under the steam-roller, and the latter for spreading on roads in frosty weather. A series of experiments, conducted at a cost of £200, has proved that every cubic yard of mud thus treated, at a cost of 8*d*. per yard, will yield about half a yard of re-usable material, worth about 5*s*. per yard. This washing machinery will be driven by steam generated in a multitubular boiler, through which the heat from the furnaces will pass before finally escaping up the chimney-shaft. Incidentally it may be mentioned that Mr. Weaver calculates that the furnaces will be capable of developing 100 horse-power — enough, if desired, to light the whole of the parish by electricity.

As to the cost, it is only the refuse of the northern-half of the parish which is to be taken to Notting Hill; that of the southern-half will be sent to the barges, as at present. The present charge for this northern district is £11,654 a year. It is estimated that the net cost under the proposed new plan would be £5,549, a saving of £6,105, this being Mr. Weaver's own calculations.

The subjoined communication, which has been addressed to a contemporary by Mr. G. R. Strachan, the surveyor of the parish of Chelsea, forms a valuable contribution on the question at issue, coming as it does from a skilled and competent witness. Mr. Strachan says:—

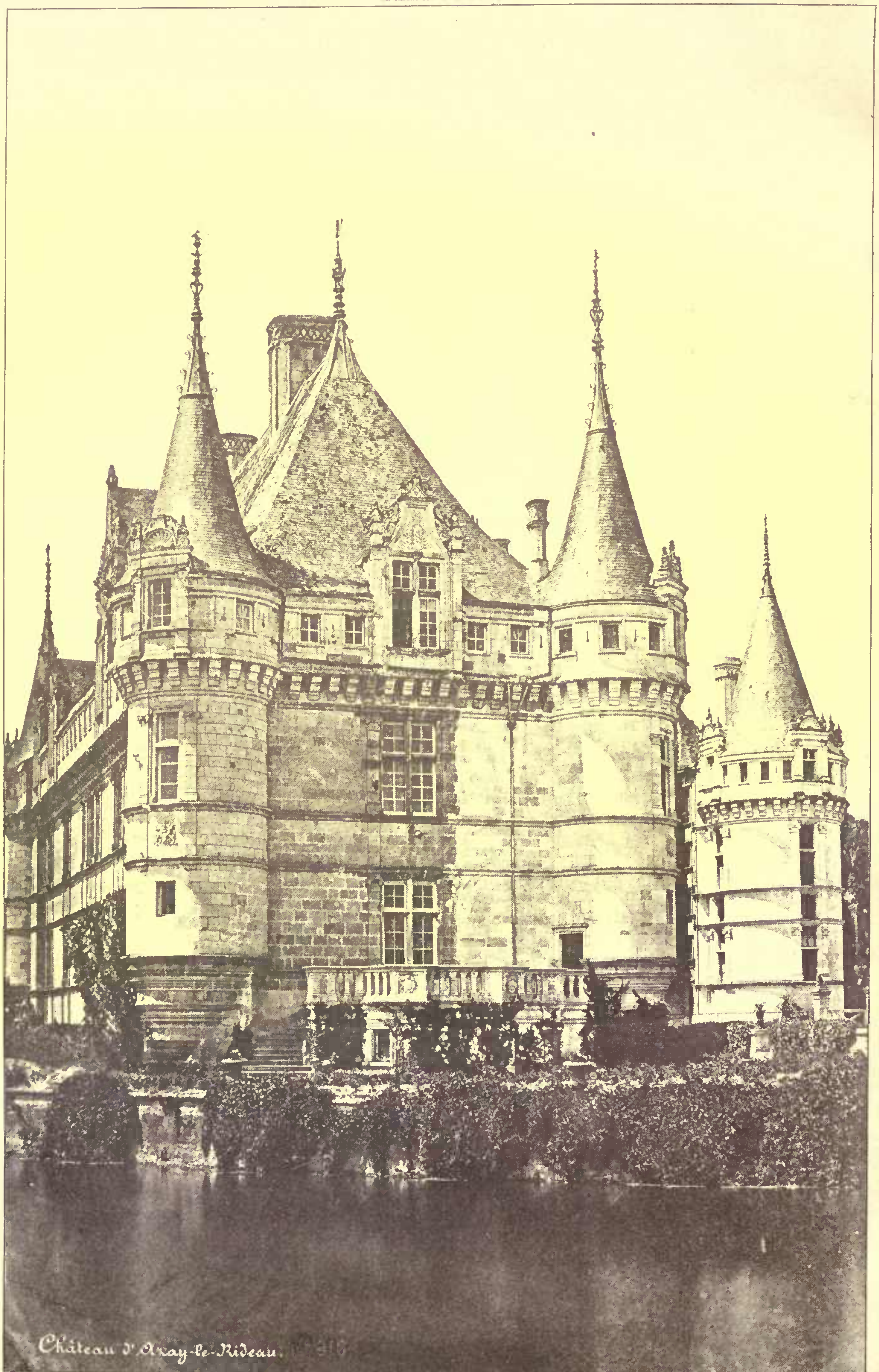
"The House of Commons is about to be asked to throw out the Kensington Vestry Bill on its third reading. The Bill as it now stands gives that vestry authority to buy land and erect a series of furnaces thereon to burn the household dust of the inhabitants of the district. It has been through the ordeal of a three days' examination in committee, when counsel, witnesses and foes were heard against it. The Committee declared the preamble proved with amendments, yet notwithstanding this, the House is invited to throw over its own committee and the bill. In other words, the House is asked to commit the mistake it made in the case of the Birmingham Sewage Bill, when a Tory minister rose and successfully moved the rejection of the bill after it had borne an exhaustive inquiry in committee — a step which is now looked back upon with all but universal regret. An act of injustice is therefore intended. It devolves

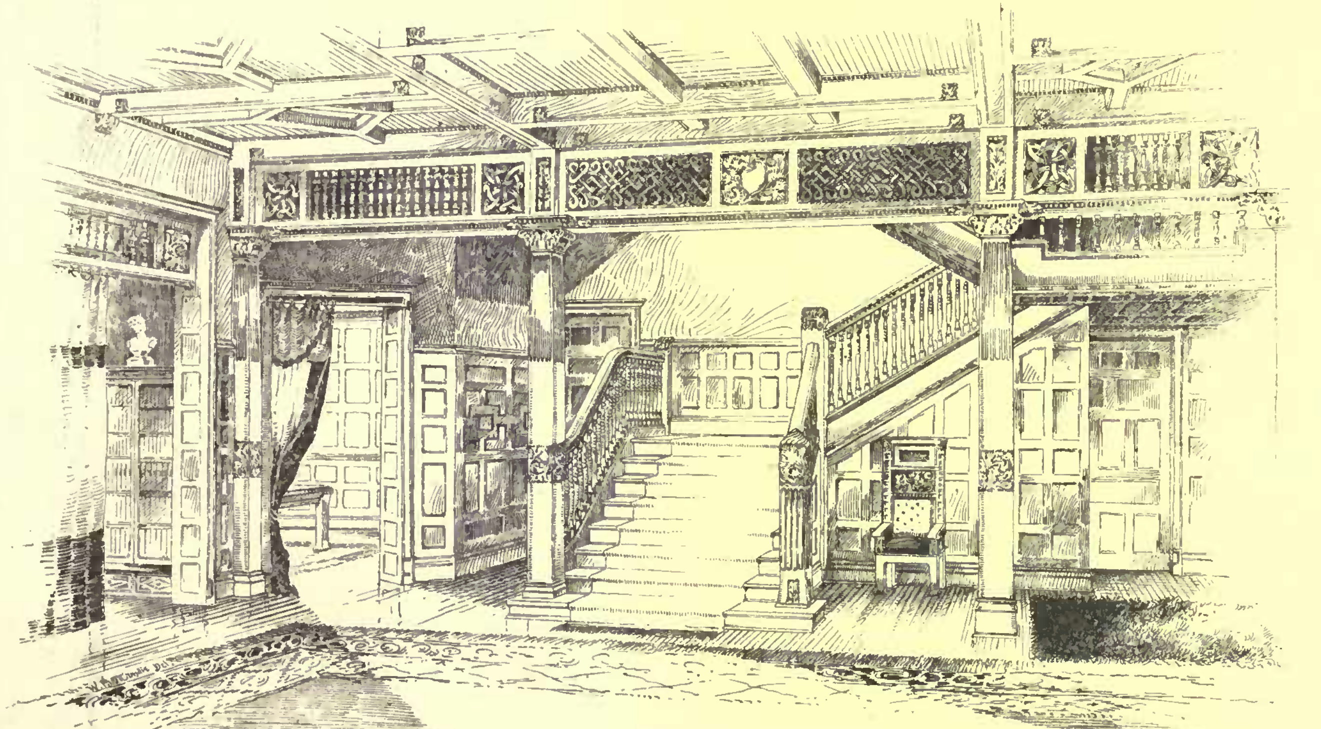


DESIGN FOR YOUNG MENS ASSOCIATION BUILDING, BUFFALO, N.Y

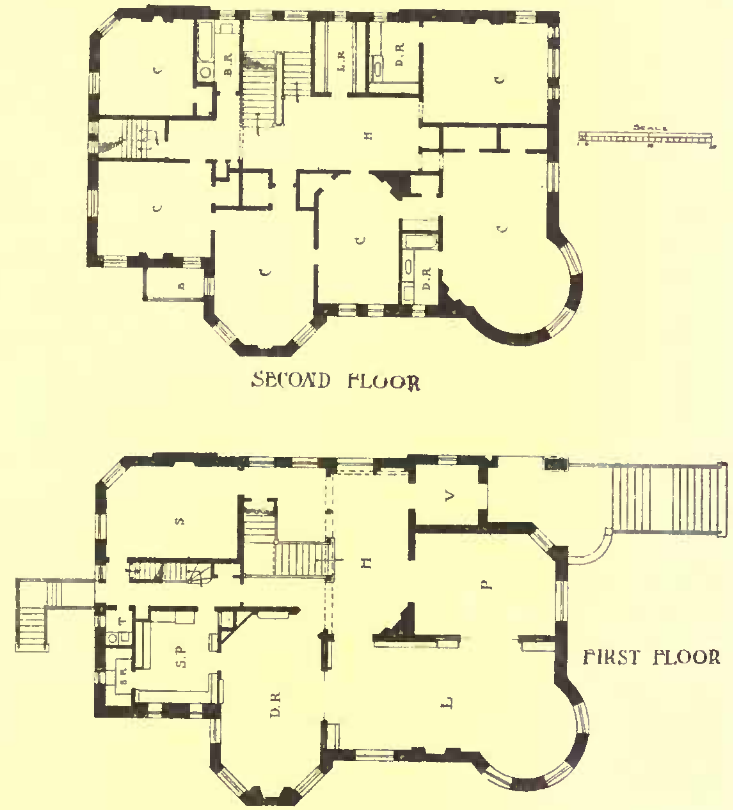
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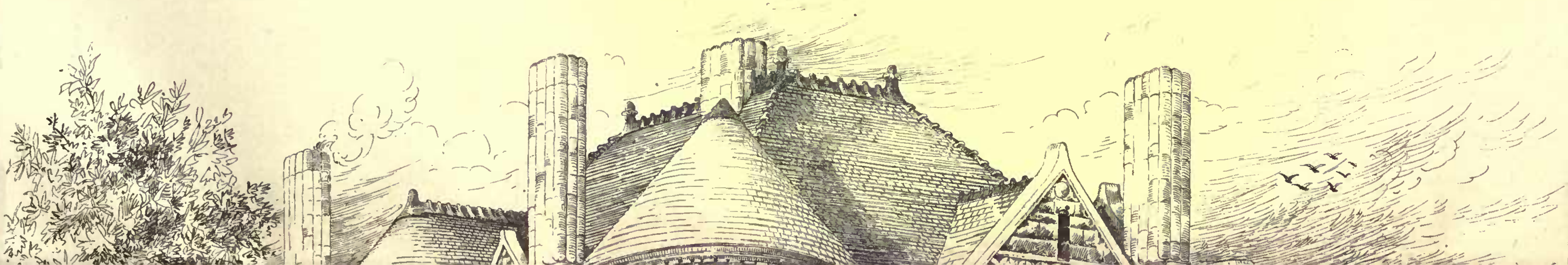
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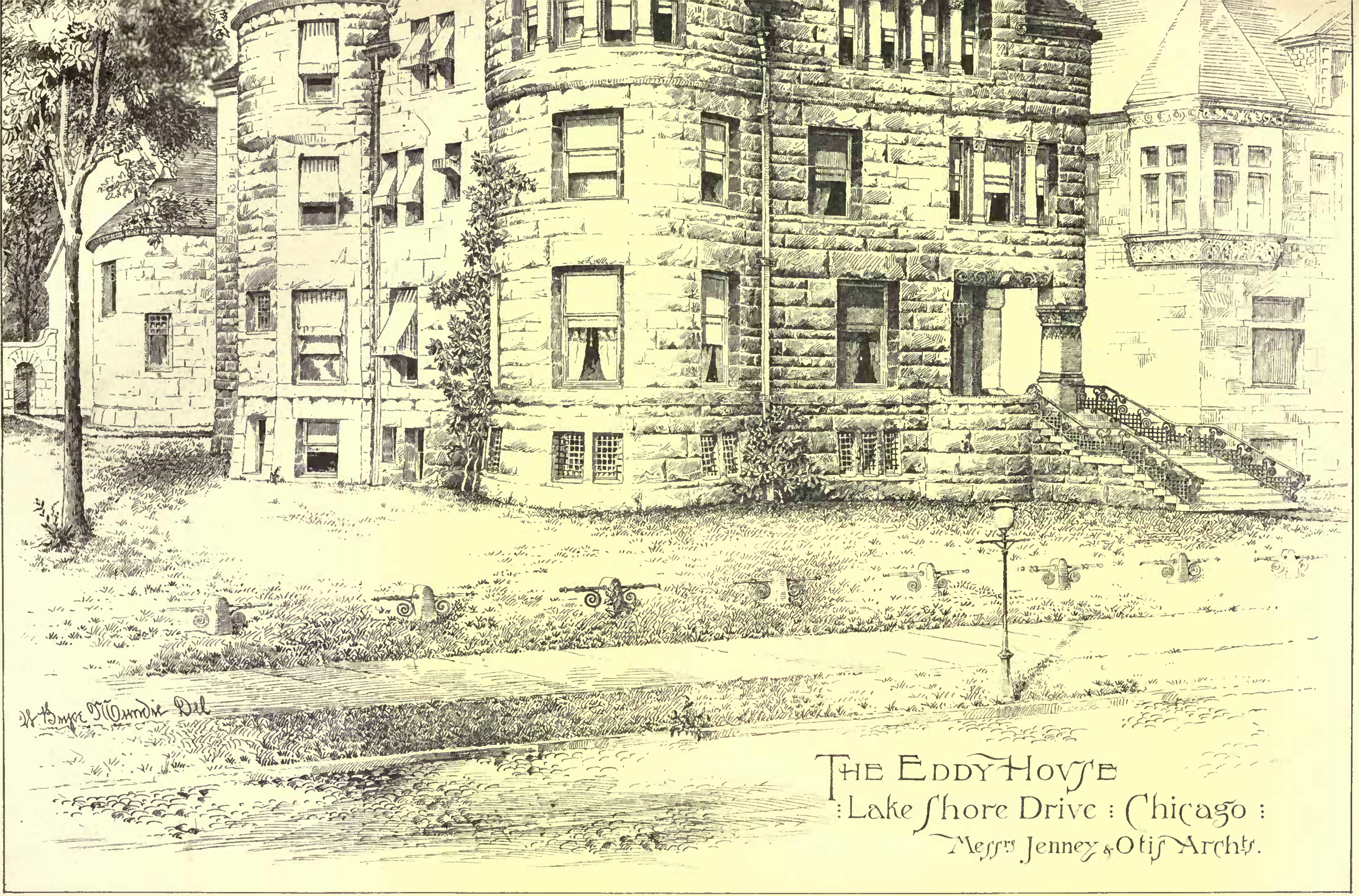

Château d'Azay-le-Rideau.



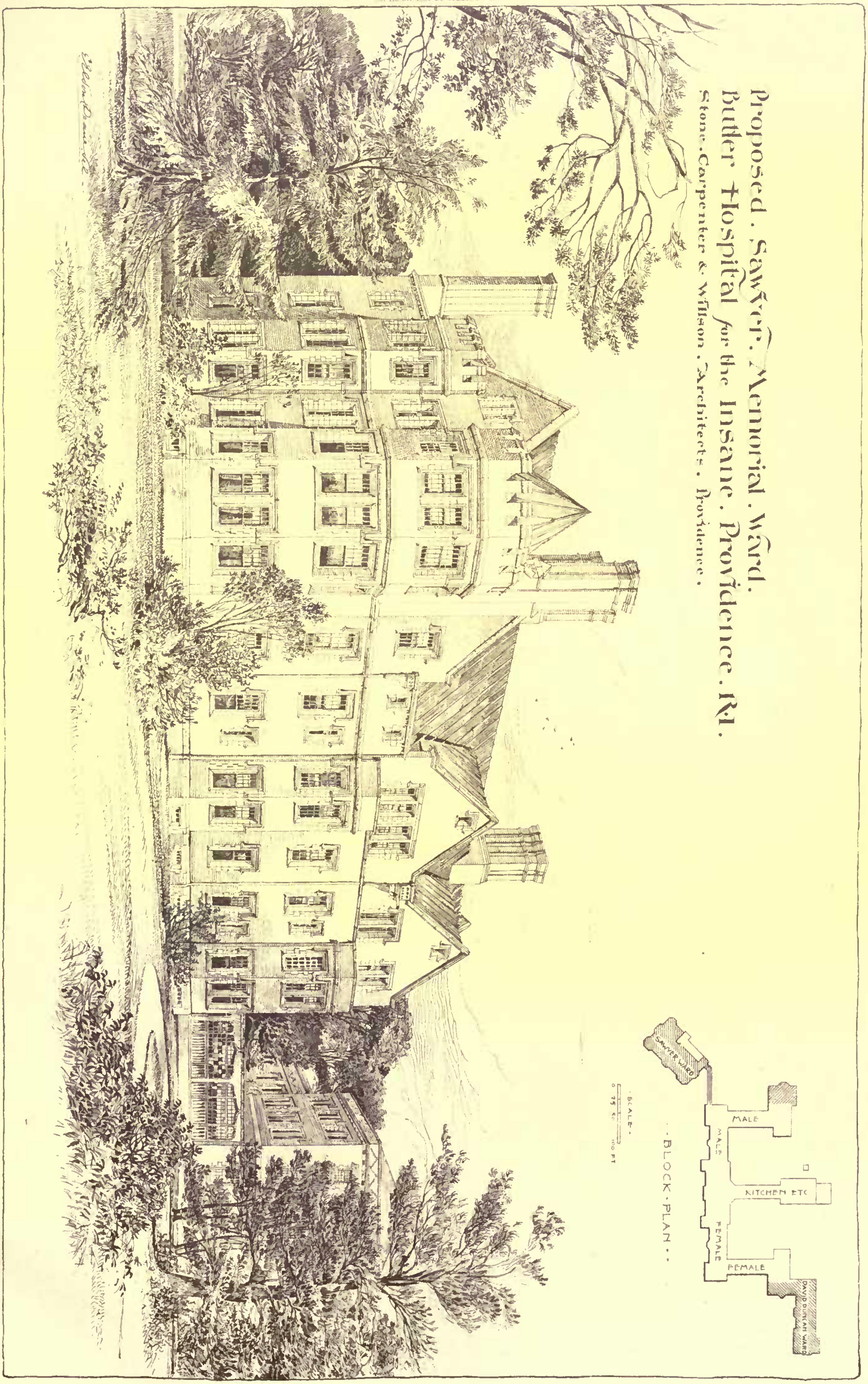
VIEW IN MAIN HALL EDDY HOUSE CHICAGO
JENNEY & OTIS ARCHTS



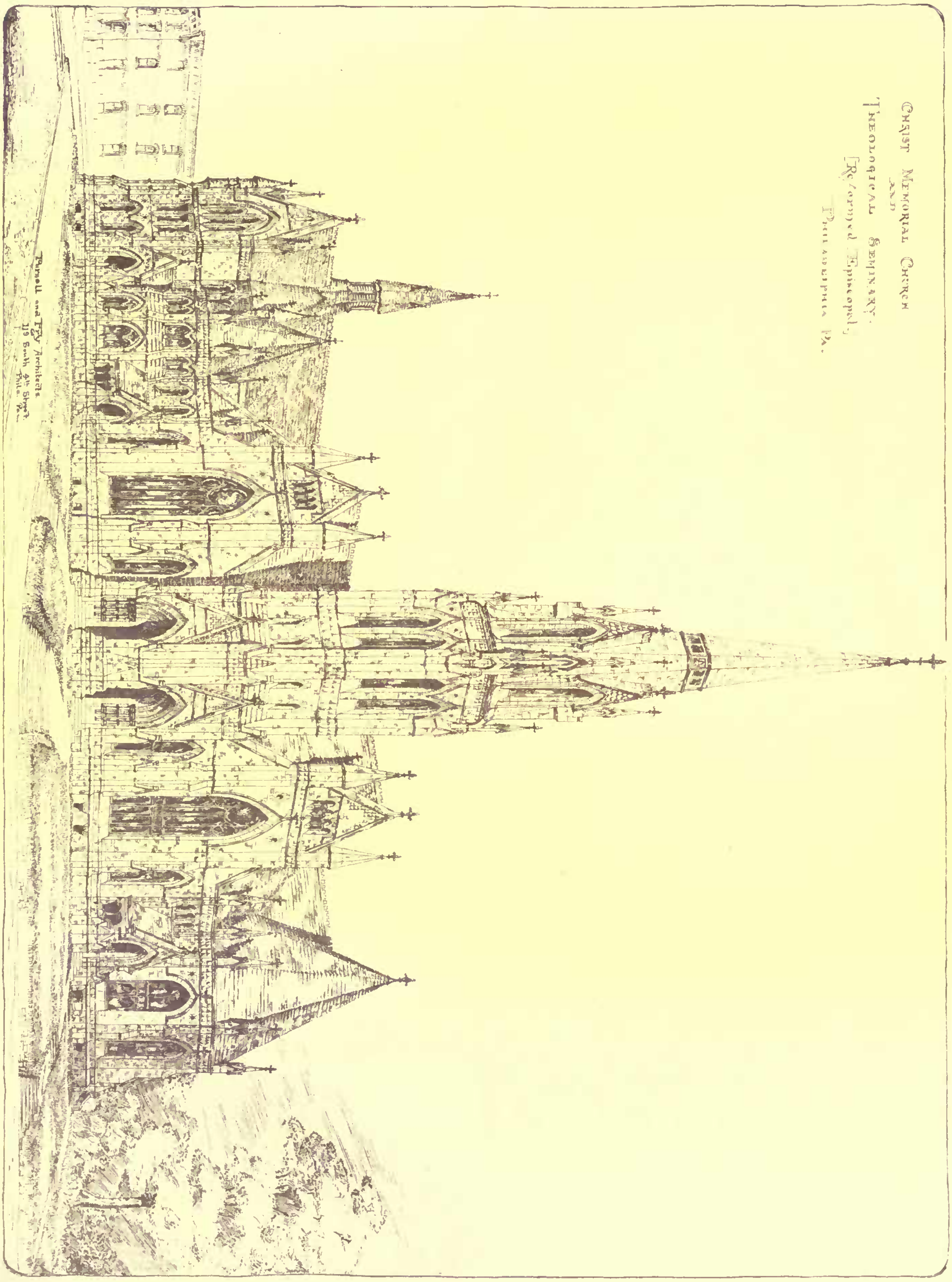




Heliotype Printing Co. Boston



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upon those who have knowledge on the question to say what they know. At Leeds, this method of disposing of the dust has been in operation for ten years. The Armley Road destructor is in a populated neighborhood, and does its work without offence or nuisance. Of Newcastle-on-Tyne, Manchester, Warrington, Nottingham, Derby, Birmingham, Southampton and Whitechapel the same can be said. I have seen each of these in operation in their everyday work, and can unhesitatingly say that the fear of nuisance from them is without foundation. The dust is destroyed as it comes in, expeditiously, and without offence. At Letts Wharf, Lambeth, against the river, the city destructor does its duty daily, and I venture to say that not one person in one hundred who passes it is aware of its existence.

"The dust disposal question is a serious one for Londoners. The Chelsea Vestry has just come to the end of a three year's contract for barging the dust down the river, under which the price paid was 8*d.* per load of three cubic yards. To-day it starts a new contract for the same end, and pays 2*s.* 3*d.* per load of three cubic yards. Three hundred and forty per cent increase in cost in three years ought to make men think twice before they deprive a vestry in a worse position than Chelsea is of a certain, harmless, and economical method of dust disposal. To persons like myself, who see huge sums of public money wasted in opposing useful and essential refuse disposal schemes, the suggested action of throwing out this bill is little short of sinful. I know of cases where property owners have exerted a most violent opposition to sewage schemes, and have been paid large sums as compensation, because they would have to leave their ancestral homes (so they said), and who put the money in their pockets, and live at the present time in the same home with the sewage-works at their door. It makes one laugh to see the same game going on at every turn. I feel convinced that when the Kensington destructor is built and in operation, the persons who are now so bitter in their opposition will wonder what caused them to make such a hubbub about the bill.

"Let me add that I have no interest in this bill beyond a general and public one, that I have not received either coin or kind from the Kensington Vestry at any time, and that I have none of that gratitude towards them which is prompted by an expectation of favors to come."

On the other hand, Mr. C. J. Perceval, Honorary Secretary of the "Museum" Ward Conservative Association of Kensington writes as follows:

"One might easily imagine from the speeches made by Sir Algernon Borthwick and Mr. Labouchere on the above subject that the inhabitants of South Kensington generally were in favor of the destructor. Such, however, is not the case; for, when the member of Parliament for Kensington South Division attended a meeting of the Museum Ward Conservative Association, on the 1st day of April last year, and a gentleman proposed that Sir A. Borthwick should be asked to support this bill, no seconder appeared, and the feeling at the meeting was strongly averse to any such waste of money. The reasons against the destructor are many: 1. It is a wicked and wilful waste of money to burn indiscriminately all the valuable refuse from this the largest parish in London. 2. That it would cost (including all expenses) little, if any, less than £100,000, which, as (3), we are already in debt (including our metropolitan share of £1,000,000) to the amount of £1,900,000, is considerably in excess of our rateable value. 4. We have the example of the parish of Newington (St. Mary) of how to deal with our refuse. The net cost to that parish, is but £1,500 per annum for scavenging, against ours of over £32,000. 5. The example of St. Mary, Newington, is being followed by Hampstead. 6. We have far greater facilities than St. Mary's, Newington; for we have the Thames, a canal, and several freight sidings of different railways in our parish. 7. Through the exertions of Mr. John Braye we have several farmers ready and willing to take all and more than we can supply them with. So that we have no excuse for this sinful extravagance; but until the rate-payers bestir themselves, and take the trouble to send up men pledged to economy, and other than those whose sole delight is in spending other people's money, we shall never lighten our heavy rates."

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE ROTCH TRAVELLING-SCHOLARSHIP DRAWINGS. — PLATES XLVI, XLVII, XLVIII.

[Issued only with the Imperial Edition.]

THE "EDDY" HOUSE, CHICAGO, ILL. MESSRS. W. L. B. JENNEY & W. A. OTIS, ARCHITECTS, CHICAGO, ILL.

THE house is situated on the Lake Shore Drive, near Lincoln Park, overlooking Lake Michigan, one of the finest building sites in the city. The material is Hallowell white granite. Interior finished in hard woods. Hall and stairway in quarter-sawed white-oak; parlor in Spanish satinwood; library and dining-room in mahogany. The style indicated by the published designs is preserved throughout the house. There is also a stable on the lot, built of Hallowell white granite, the interior trimmed in Georgia pine finished with spar varnish.

DESIGN SUBMITTED FOR THE YOUNG MEN'S CHRISTIAN ASSOCIATION BUILDING, BUFFALO, N. Y. H. H. RICHARDSON, ARCHITECT.

MR. RICHARDSON was very unwilling to have any of his unexecuted designs published, and that is probably the reason that this design was first exhibited in the pages of an English contemporary, the *Building News.*

CHRIST MEMORIAL CHURCH AND THEOLOGICAL SEMINARY, PHILADELPHIA, PA. MESSRS. PURSELL & FRY, ARCHITECTS, PHILADELPHIA, PA.

THIS church, which is now building at the corner of 43d and Chestnut streets, will cost $150,000.

PROPOSED SAWYER MEMORIAL WARD FOR THE BUTLER HOSPITAL FOR THE INSANE, PROVIDENCE, R. I. MESSRS. STONE, CARPENTER & WILLSON, ARCHITECTS, PROVIDENCE, R. I.

CHATEAU AT AZAY-LE-RIDEAU, FRANCE.

NOTE. — Circumstances obliged us to use, last week, a gelatine print sooner than we expected, and consequently we were not then prepared to say that the architect of St. Thomas's Church was Mr. R. M. Upjohn, while the houses for Messrs. Webb and Twombley were designed by Mr. C. B. Atwood, both of New York.

BRICKWORK.



IN a recent lecture, delivered at Carpenter's Hall, London, Professor T. Roger Smith, F.R.I.B.A., after describing the kinds and processes of making bricks, said: So much for bricks. To make brickwork, however, another ingredient is required — namely, mortar or cement. All mortars, and, in fact, all the cementing materials used (except bituminous ones) in bricklaying have lime as their base, and depend upon the setting quality of quicklime, which has to be mixed with sand or some suitable substitute for it, to make mortars. Limes and cements are far too wide a subject to be dealt with as part of an evening's lecture on another topic, and no doubt they will hereafter form the subject of a lecture or lectures. To-night I propose only to remind you that there are such substances as these, and that they possess certain qualities and are obtainable and available for the bricklayer's purposes, without attempting an investigation into the chemistry of cements, or the manufacture, etc. Ordinarily, brickwork may be divided into brickwork in mortar and in cement; but there are many qualities of mortar, and several sorts of cement. Mortar made with what are called fat or rich limes — that is to say, nearly pure lime, such as is got by calcining marble or pure chalk, sets slowly, with difficulty, and is rarely tenacious. Burnt clay or brick reduced to powder improves the setting of such lime, especially if the two materials be calcined together; so will an admixture of cement. Mortar made with what is known as slightly hydraulic lime — that is to say, lime containing a small proportion of clay, such as the gray stone lime of Dorking, Merstham, and that neighborhood, sets well, and is tenacious and strong. Mortar made with hydraulic lime — that is to say, lime with a considerable admixture of clay, such as the lias lime, sets under water or in contact with wet earth. It is best to use this lime ground to powder, and not to mix so much sand with it as is used with stone lime.

A sort of mortar called selenitic mortar, the invention of the late General Scott, has been made use of in many of the buildings of the School Board for London, and was first employed on a large scale in the erection of the Albert Hall. The peculiarity consists in the addition of a small dose of plaster-of-Paris (sulphate of lime) very carefully introduced and intimately mixed. The result is that the mortar so made sets rapidly and is very hard. It is claimed that a larger proportion of sand can be used with selenitic lime than with ordinary, thus counterbalancing the extra expense occasioned by royalty under the patent and special care in mixing. When a limestone contains twenty to forty per cent of clay, it becomes what is called a cement, and its behavior is different from that of limestones with less clay. Ordinary limestones are, as you know, calcined in a kiln. The

material which comes from the kiln is called quicklime, and, on being dosed with water, it slakes, and crumbles to powder, and in the state of slaked lime is mixed up with mortar.

Cement-stones are also calcined; but the resulting material will not fall to pieces or slake under water. It must be ground very fine, and when moistened sets rapidly, and as well under water as in air, and becomes very hard and is very tenacious. Brickwork in mortar will always settle and compress to some extent. Not so brickwork in cement, which occasionally expands, but is never to be compressed. This quality and the rapid setting, tenacity and strength of brickwork in cement make it a most valuable material to use in those buildings or parts of a building where great steadiness and strength are wanted, and in sewage and dock work, where there is water to contend with. A good many cements made from natural stones used to be employed, such as Medina, Harwich, Atkinson's or Roman cements. The last named is the only one which is now much employed, except locally. It has the quality of setting with exceptional rapidity, and is on that account sometimes the best material to employ; but for almost every purpose the artificial compound known as Portland cement is preferable. Portland cement is made largely near Rochester. Its materials are simple and cheap. They may, without much departure from the truth, be said to be Thames mud and chalk; but the process of manufacture requires care and thoroughness. The article supplied, when of the best quality, has great strength, and is quick-setting, and is far better than what was manufactured from stones in which the ingredients existed in a state of nature.

In England we slake our lime and make use of it while it is fresh; but it may interest you to know that the custom in Italy and parts of France is different. There it is customary to slake the lime long before it is wanted, and to deposit it in a pit and cover it up with earth. In this condition it is left for months — I believe in Italy for a year — and when taken out it is stiff, but still a pasty substance. It is beaten, and more water added, and it is then made into mortar with sand. It is claimed for mortar made in this way that it is exceptionally strong.

Now that we have considered bricks and partly considered mortar, it remains to pay some attention to brickwork. The simplest and most familiar work for a bricklayer to do is to build a wall. In doing this his object should be to make it as stout as possible for the thickness, and this stoutness can only be obtained by interlacing the bricks. If they were simply laid on the top of each other the wall would be no more than a row of disconnected piles of brick liable to tumble down. When the whole is so adjusted that throughout the entire wall the joints in one course shall rest on solid bricks and shall be covered by solid bricks again — in short, when the whole shall break joint — then this wall is said to be properly bonded, and has as much stability given to it as it can possibly possess. There are two systems of bonding in use in London, known as English bond and Flemish bond. English bond is the method which we find followed in ancient brickwork in this country. In this system a course of bricks is laid across the wall, showing their heads at the surface, hence called "headers," and next above comes a course of bricks stretching lengthways of the wall, called "stretchers," and so on alternately. With the Dutch fashions came in Flemish bond, in which, in each course, a header and a stretcher alternate. In either case, at the corners, a quarter-brick, called a closer, has to be used in each alternate course to complete the breaking joint. There is not much to choose between these methods where the walls are only one brick thick; but where they are thicker the English has a decided advantage, for in walls built in Flemish bond of one and a half brick thickness or more there must be a few broken bricks, or bats, and there is a strong temptation to make use of many. If this takes place, the wall is unsound. Many of the failures of brickwork in London houses arises from the external walls, where they are one and one-half bricks thick, being virtually in two skins; the inner nine inches does the whole of the work of supporting floors and roof, and when it begins to fail, the outer face bulges off like a large blister. I have known cases where this had occurred, and where there was no header-brick for yards, so that one could pass a five-foot rod into the space between the two skins and turn it about. This is rather less easy to accomplish with English bond, and there are other advantages in the use of that bond which make it decidedly preferable, and it is now coming back into very general use. There are some old varieties of bond, such as garden-bond and chimney-bond; but of these I only wish to draw your attention to what is called cross bond. The name is not quite a happy one. Diagonal bond is hardly better. The thing itself is to be often met with on the Continent, and it is almost unknown here; but it would be worth introducing, as the effect of it is very good. French cross bond, otherwise diagonal bond (*liaison en croix*), is English bond, but with the peculiarity that in every fourth course one header is made use of in the stretcher course at the quoin. The result is that the stretchers break joint with each other, and all the joints range themselves in diagonal lines, and if, in any part of the work, headers of a different brick are introduced, the appearance of a cross is at once brought out; and even without this the diagonal arrangement of joints is very perceptible and pleasing. Besides wall-building, the bricklayer has many other works to perform. He has to form fireplaces, flues, chimneys, and the flat trimmer-arches which support the hearth, and has to set the stove, kitchen-range, copper, etc., in a proper manner. He has to form various ornamental features, and much else, some of which we shall have an opportunity of noticing rather later.

The strangest business, however, which is intrusted to the bricklayer, is building downwards — by the method known as underpinning — so that, if a foundation has failed, a sounder one at a greater depth may be reached; or, if a basement is required under an existing building which has none, the space may be excavated and the new walls built so as to maintain the old. This work has to be done with great caution, and bit by bit, and is usually left to experienced hands. The mode in which the mortar joints of a brick wall are finished where they show on the external or internal face is a matter worth a moment's attention. It is important that the joints of the work shall be so finished as to keep out wet and to be as durable as possible, and it is desirable that they should improve, or, at any rate, not disfigure the appearance of the work. The method which architects strongly advocate is that the joints shall be struck as the work proceeds — that is, that very shortly after a brick is laid, and while the mortar is yet soft, the bricklayer shall draw his trowel, or a tool made for the purpose, across it, to give it a smooth and a sloping surface. This is best when the joint is what is called a weather-joint — *i.e.*, one in which the joint slopes outward. Sloping it inward is not good, as it lets in wet; finishing it with a hollow on the face is often practised, and is not bad. Bricklayers, however, most of them prefer that the mortar joints should be raked out and pointed — that is to say, an inch or an inch-and-a-half of the mortar next the outer face be scratched out and replaced with fresh mortar, and finished to a line. In cases where the brickwork is exposed to frost, this proceeding cannot be avoided, because the frost damages the external mortar of the joints; but the bricklayers prefer it at all seasons of the year, partly because brickwork is more quickly done if joints are not struck at the time; partly because they can, if they like, wash the whole surface of the work with ochre, or other color, to improve the tint; and partly because, whether the washing is done or not, it smartens up the appearance of the work. The misfortune is that this pointing, instead of being the edge of the same mortar that goes right through, is only the edge of a narrow strip, and does not hold on to the old undisturbed mortar, and so is far less sound, and far more liable to decay. There is a system of improving the appearance of old decayed work by raking out and filling up the joint, and then making a narrow mortar joint in the middle of this filling in, and projecting from the face. This is called tuck-pointing; it is very specious, but it is not sound work.

Brick arches are constantly being turned, and of many sorts. An arch consists of a series of wedge-shaped blocks, known as voussoirs, arranged in a curve, and so locking one another together that unless the abutments from which the arch springs gives way, it will not only carry itself, but sustain a heavy load. It is a constant practice to cut bricks to this shape and build them into an arch, and these are sometimes cut and rubbed; sometimes, when the work is rougher, they are axed. But in order to save the labor of cutting, arches are sometimes turned with the bricks left square, and the joints wedge-shaped. In this case the rings should be only half a brick each, so that the wedge need not be so very much wider at back than at face, and they are set in cement, as that material adheres so closely and sets so hard. Arches of two or more half-brick rings in cement are good construction, and are also used for culvert work. A less satisfactory sort of arch is what is called the flat arch. Here, instead of being cambered as it ought to be, the soffit is straight; but the brickwork being deep, there is room enough for a true arch that does the work, and for useless material to hang from it. These arches are generally rubbed or axed, and are very common at the openings of ordinary windows; but no one who has studied construction can look at them without a kind of wish for at least a slight rise, were it only two inches. Sometimes, when these straight arches are to be plastered over, they are constructed in a very clumsy manner, which is anything but sound, and from time to time they give way.

The weight of brickwork, of course, varies with the weight of the individual bricks; but stock brickwork in mortar weighs just about one hundredweight per cubic foot, or twenty cubic feet to the ton. In cement it is heavier, about one hundred and twenty pounds to the cubic foot. The strength of brickwork depends, of course, on the strength of the weakest material — *i.e.*, the mortar; though when it is in cement the strength of brickwork to withstand a weight probably approaches that of the individual bricks. Some experiments quoted in Rivington's "*Notes*" give the following as the crushing weight per foot — that is to say, weight at which crushing began — of piers having a height of less than twelve times their diameter.

	Tons per foot.
Best stocks, set in Portland cement and sand 1 to 1, and 3 months old	40
Ordinary good stocks, 3 months old	30
Hard stocks, Roman cement and sand 1 to 1, 3 months old	28
Hard stocks, lias lime and sand 1 to 2, and 6 months old	24
Hard stocks, gray chalk lime and sand, six months old	12

The rule given in a popular hand-book, that brickwork in mortar should not have to carry more than three tons per superficial foot, and in cement more than five tons, is probably sound, as in no building ought the load to approach the crushing point, and, indeed, there are many sorts of foundations on which such a load as five tons per foot would be too great to be advisable.

It is a rather interesting inquiry, whenever we are dealing with a building-material, if we ask what can we best do with it, and for what is it ill-fitted. The purposes for which brick can be best used depend, of course, upon its qualities. Speaking generally, such purposes are very numerous and very various, especially the utilitarian

purposes, though rich and varied ornamental work can also be executed in brickwork. Perhaps the most remarkable quality of brickwork is that it can be thrown into almost any shape. It is in this respect almost like a plastic material, and this peculiarity it owes chiefly to the very small sizes of each brick as compared with the large masses of brickwork of most buildings. Stone is far less easily dealt with than brick in this respect. Think for a moment of the great variety of walls, footings, piers, pilasters, openings, recesses, flues, chimney-breasts, chimney-shafts, vaults, arches, domes, fireproof floors, corbels, strings, cappings, panels, cornices, plinths, and other features met with in constant use, and all formed by the bricklayer with little trouble out of the one material — brickwork! A little consideration will convince you that if the same material furnishes all these it must be very plastic. As a limitation, we ought to note that this almost plastic material cannot be suddenly and violently dealt with — that is to say, that, with the exception of some sorts of arches, you cannot form any abrupt or startling feature in brickwork, and you are especially limited as to projections. If you wish to throw out any bold projection, you may support it on a long and sloping corbel of brickwork; but if there is not room for that you must call in some other material, and form the actual support in stone, or terra-cotta, or iron, and when you have gained your projection you may then go on in brickwork if you like. Brick cornices should be steep, but cannot be bold, and so with other ornamental and structural features.

A noteworthy property of brickwork, and one of immense value, is that it is thoroughly fireproof; in fact, almost the only perfectly fireproof material. There is an interesting account of the Great Fire of London, by one of the eye-witnesses, and among the striking phenomena of that awful time he notes that the few brick buildings which existed were the only ones able to withstand the raging fire when it reached them. In our own day a striking proof of the same thing was given in the great fire in Tooley Street, when Braidwood lost his life. I witnessed that conflagration for a time from London Bridge, and its fury was something not to be described. There were vaults under some of the warehouses stored with inflammable materials, the contents of which caught fire and burnt for a fortnight, defying all attempts to put them out; yet these very vaults, though they were blazing furnaces for all that time, were not materially injured. When the warehouses came to be reinstated it was only found necessary to repair and repoint them a little, and they were retained in use. The fact is, that the bricks have been calcined already, so has the lime in the mortar, and the sand is not affected by heat, so there is nothing in brickwork to burn. Against each of these good qualities, however, we may set a corresponding defect. If brickwork is easily thrown into any shape, it is also easily thrown out of shape. It has little coherence or stability, less than masonry, and very considerably less than timber. If any unequal settlement in the foundation of a brick building occurs, those long zigzag cracks with which we, in London, are only too familiar, set themselves up at once, and if any undue load, or any variation in load, exists, the brickwork begins to bulge. Any serious shock may cause a building of ordinary brickwork to collapse altogether, and, from time to time, a formidable accident occurs owing to this cause. The fact is, the bricks are each so small compared to the mass of the work, and the tenacity or hold upon them of even fairly-good lime-mortar is so comparatively slight that there is really but little grip of one put upon another.

Persons who have to design and construct brick buildings should never forget that they have to be handled with caution, and are really very ticklish and unstable. One or two of the methods of overcoming this to some extent may be mentioned. The first is the introduction of what is called bond. At the end of the last century it was usual to build in, at every few feet in height, bond-timbers, which were embedded in the heart of the walls. If these had always remained indestructible, they would, no doubt, have served their purpose to some extent. Unfortunately, timber both rots and burns, and this bond-timber has brought down many a wall, owing to its being destroyed by fire, and has, in other cases, decayed away, and caused cracks, settlements, and failures. The more modern method of introducing a strong horizontal tie is to build into the wall a group of bands of thin iron, such as some sorts of barrels are hooped with — hence called hoop-iron. The courses of bricks, where this occurs, must be laid in cement, because iron in contact with cement does not perish as it does in contact with mortar. If in every story of a building four or five courses are thus laid and fortified, a great deal of strength is given to the structure. Another method, which has rather fallen into disuse, is grouting. This is pouring liquid mortar, about the consistency of gruel, upon the work at about every fourth course. The result is to fill up all interstices and cavities, and to delay the drying of the mortar, and brickwork so treated sets extremely hard. I have seen a wall that had been so treated cut into, and it was quite as easy to cut the bricks (sound ones though they were) as the mortar joints. Grouting is objected to because it interferes with the good look of the work, as it is very difficult to prevent streaks of it from running down the face, and it is apt to delay the work; but it is a valuable means of obtaining strong brickwork. Another and a more popular method is to build the work in cement, now usually Portland cement. This, of course, makes very strong, sound work, and does not involve any delay or dirt, like grouting, or the introduction of any fresh material, like hoop-iron; but it, of course, adds to the expense of the work considerably, as cement is much more costly than lime. I ought to add that the advocates of Scott's selenitic mortar claim that it not only sets quickly and hard, but that it is extremely tenacious, and consequently makes a much more robust wall than ordinary mortar. I daresay this is true; but I have not happened to see such a wall cut into, and this is the best test of solidity.

The second deficiency in brickwork which I am bound to notice is that, though it is very fireproof, it is far from being waterproof. In an exposed situation rain will drive completely through a tolerably stout brick wall. If water be allowed to drop or fall against it, the wall will become saturated like a sponge. If the foot of a wall becomes wet, or if the earth resting against the lower parts of it be moist, water will, if not checked, rise to a great height in it, and if the upper part of the wall be wet, the water will sink downwards. With most sorts of brick the outer face absorbs moisture whenever the weather is moist, and in time the action of the rain, and the subsequent action of frost upon the moisture so taken up, destroys the mortar in the joints, which are to be seen perfectly open, as if they had been raked out, in old brickwork, and in some cases (happily, not in many) the action of weather destroys the bricks themselves, the face decaying away, and the brick becoming soft. Against this serious defect in our staple building-material a series of precautions have been devised. Damp rising from the foot of the wall, or from earth lying round its base, is combated by a damp-course — a bed of some impervious material going through the wall. Damp earth may be kept off by surrounding the walls with an open area or a closed one — usually termed a dry area. Damp against the face of the walls may be partly combated by a careful selection of a non-absorbent brick with a hard face and by struck joints; but it is most effectually kept at bay by the expedient of building the wall hollow: that is to say, making the external wall of the house to consist of two perfectly distinct walls, standing about two inches apart, and held together by ties of earthenware or iron. The result is that the moisture blowing through the outer skin does not pass the cavity, but trickles down on the inner face of the outer wall, while the inner wall remains dry. The ties are constructed of shapes to prevent their conducting water themselves from without to the inner wall. In addition to this, a series of slates forming an intermediate protection is sometimes introduced, and forms an additional and most valuable screen against weather. Sometimes, the two skins of the wall are closer together — say three-quarters of an inch — and the space is filled with a bituminous material. A substance of a bituminous nature, called hygeian rock, has been, of late years introduced, and is being extensively used for this purpose — it is melted and poured into the open space hot, and quickly hardens. The use of such a material is open to the objection that no air can pass through it. The rooms of our houses are receiving air constantly through the walls, and much of the constant current up our chimneys is supplied, to our great advantage, in this very imperceptible manner. The house breathes, so to speak, through the pores of its brickwork. When this is rendered impossible, it seems clear that fiercer draughts will enter through the chinks and crevices, and that there will be a greater demand upon flues not in use, occasioning down-draught in the chimneys. Another mode of keeping out weather is to cement the face of the brickwork; but this hides up the work, and so tends to promote bad work, besides being often very unsightly.

Among other peculiarities of brickwork are the facilities for introducing different colors and different textures of surface, which it presents, the ease with which openings and arches can be formed in it, the possibility of executing ornament and even carving, and the ease with which brickwork will combine with other building materials. It cannot be well made use of for columns, though it may readily enough be turned into piers or pilasters. It cannot, generally speaking, with advantage be made use of for any large domes, though the inner dome of St. Paul's and the intermediate cone are of brick and stand well; but it is an excellent material for vaulting arcades and all purposes involving the turning of arches. Brickwork must be said to be durable, but it requires care. If not of the best, brickwork within the reach of the constant vibration caused by the traffic on a railway seems to be in danger of being shaken to pieces, judging from one or two instances that have come under my own observation. The mortar, and even in some cases the bricks themselves, will rapidly deteriorate if moisture be allowed to get into the heart of a brick wall, and in exposed situations this is very apt to happen. Care should always be taken to keep the pointing of external brickwork in good order, and to maintain all copings and other projections intended to bar the access of water coming down from above, and to stop the overflowing of gutters and stack-pipes, which soon soaks the wall through and through. Of course, if there is a failure of foundations, brickwork, as was pointed out earlier, becomes affected at once; but if these be good, and the materials used be sound ones, and if the other precautions just recommended be taken, it will last strong and sturdy for an immense length of time. In some cases, as, for example, in the Roman ruins, it has stood for fifteen hundred years under every possible exposure and neglect, and still shows something of a sturdy existence after all, though sadly mutilated. If we now return to the question, what can be well done in brickwork, no better answer can be given than to point to what has been and is being done, especially in London, and within our own reach and observation. Great engineering works, such as railway viaducts, the lining of railway tunnels, the piers and even the arches of bridges, sewage-works, dock and wharf walls, furnace

chimneys, and other works of this sort, are chiefly done in brickwork; and notwithstanding that iron is far more used by the engineer for some purposes and concrete for others now than formerly, still there is a great field for brickwork.

The late Mr. Brunel, who was fond of pushing size to extremes, tried how wide a span he could arch over with brickwork; and I believe the bridge which carries the G. W. R. over the Thames at Maidenhead has the widest arch he or any other engineer has successfully erected in brick. This arch has, it is stated, a span of one hundred and twenty-eight feet. It is segmental, the radius being one hundred and sixty-nine feet, and the rise from springing to crown twenty-four feet, and the depth of the arch five feet three inches. Now-a-days, of course, no one would dream of anything but an iron-girder bridge in such a position. Mr. Brunel's father, when he constructed the Thames Tunnel, lined it with brickwork, foot by foot, as he went on, and that lining sustained the heavy weight of the bed of the river and the river itself. If you leave London by either of the Southern lines, all of which are at a high level, you go for miles on viaducts consisting of brick arches carried on brick walls. If you leave by the Northern lines, you plunge into tunnel after tunnel lined with brickwork, and kept secure by such lining. Mile after mile of London streets, and those in the suburbs, present to the eye little but brick buildings; dwelling-houses, shops, warehouses, succeed one another, all in brickwork, and even when the eye seems to catch a change, it is more apparent than real. The white mansions of Tyburnia, Belgravia, South Kensington, and the neat villas of the suburbs are only brickwork, with a thin coat of stucco, which serves the purpose of concealing the real structure — often only too much in need of concealment — with a material supposed to be a little more sightly, and certainly capable of keeping the weather out rather more effectually than common brickwork would. More than this, such fine structures, apparently built entirely of stone, as are being put up for commercial purposes in the streets of the city, and for public purposes throughout London, are all of them nothing more than brick fabrics with a facing of masonry. Examine one of them in progress and you will find the foundations and vaults of brickwork, and not only the interior walls, but the main part of the front wall, executed in brickwork, and the stone only skin deep.

There are, however, two or three ways of making use of brickwork without covering it up, and of gaining good architectural effects thereby, and to these I beg now to direct your attention. The architect who desires to make an effective brick building, which shall honestly proclaim to all the world that it is of brick, may do this, and, if he will, may do it successfully by employing brickwork and no other material, but making the best use of the opportunities which it affords, or he may erect his building of brickwork and stone combined, or of brickwork and terra-cotta. Mr. Robson, till lately the architect to the School Board for London, has the merit of having put down in every part of the metropolis a series of well-contrived and well-designed buildings, the exterior of which, almost without exception, consists of brickwork only. If you examine one of his school-houses you will see that his walls are of ordinary stock brickwork, but usually brightened up by a little red brick at each angle, and surmounted by well-contrasted gables, and with lofty well-designed chimneys rising from the tiled roof. The window openings and doorways are marked by brickwork, usually also red, and sometimes moulded, and though I personally must differ from the taste which selected some of the forms employed (they are those in use in this country in the seventeenth and the last centuries), I cordially recognize that with very simple and inexpensive means exceedingly good, appropriate and effective buildings have been designed. Among examples of architecture wholly, or almost wholly, executed in red brick, I cannot pass over a building built many years ago, little known on account of its obscure situation, but a gem in its way. I allude to the schools designed by Mr. Wilde, and built in Castle Street, Endell Street. Of buildings where a small amount of stone is introduced into brickwork we have a good many fine specimens in London. One of the best — probably the best — is the library in Lincoln's Inn Fields. This is a large and picturesque pile, built under Mr. Hardwick as architect, in red brick, with patterns in the blank parts of the walls done in black brick. It has splendid moulded brick chimneys, and the mullions of the windows, the copings, the entrances, and some other architectural features done in stone. The building is a good reproduction of the style of building in Tudor times, when, as has been already mentioned, brickwork was taken into favor. Another building of the same class, but not so good, is the older part of the Consumption Hospital at Brompton. Brickwork, with a little stone, has been very successfully employed as the material for churches, and in many such cases the interior is of unplastered brickwork. Such churches often attain, when designed by skilful hands, great dignity and breadth of effect. St. Alban's, Holborn; the great church designed by Mr. Butterfield in Margaret Street; Mr. Street's church near Vincent Square, Westminster; and several churches of Mr. Brook's, such as he was kind enough to enable me to illustrate to-night, may be mentioned as examples of the sort. Mr. Waterhouse has built an elaborate Congregational church at Hampstead, which shows the use with which such effects of color may be obtained in interiors, and has kindly lent some drawings. Mr. Pearson's church at Kilburn may also be referred to as a fine example of brick vaulting.

Brick and terra-cotta seem to have a natural affinity for one another. Terra-cotta is no more than a refined brick, made of the same sort of material, only in every respect more carefully, and kiln baked. Its similarity to brick is such that there is no sense of incongruity if moulded or carved brickwork and terra-cotta are both employed in the same building, and this can hardly be said to be the case if the attempt is made to combine ornamental brickwork and stone ornaments. At South Kensington a whole group of examples of brickwork with terra-cotta meets us. The Natural History Museum, the finest of them all, is hardly fit for our present purpose, and it is as completely encased in terra-cotta as the fronts of the buildings in this avenue are in stone. But here are the Albert Hall, a fine specimen of mass and effect; the City and Guilds Institute; the College of Music, and some private houses, and blocks of flats, all in red brick with terra-cotta, and all showing the happy manner in which the two materials can be blended. In most of them there is a contrast of color; but Mr. Waterhouse, in the Technical Institute, has employed red terra-cotta with red bricks, as he also has done in his fine St. Paul's School at Hammersmith, and Mr. Norman Shaw has, in his fine pile of buildings in St. James's Street. The combination — namely, brick and terra-cotta — I look upon as the best for withstanding the London climate, and for making full use of the capabilities of brickwork that can be employed, and I have no doubt that in the future it will be frequently resorted to. Some of those examples also show the introduction of cast ornaments, and others the employment of carving as means of enriching the surface of brick walls with excellent effect. Here we must leave the subject; but, in closing, I cannot forbear pointing to the art of the bricklayer as a fine example of what may be accomplished by steady perseverance. Every brick in the miles of viaducts or tunnels, houses or public buildings, to which we have made allusion, was laid separately, and it is only steady perseverance, brick after brick, on the part of the bricklayer, which could have raised these great masses of work. Let me add that no one brick out of the many laid is of no importance. Some time ago a great fire occurred in a public asylum, and about £2,000 of damage was done, and the lives of many of the inmates endangered. When the origin of this fire came to be traced out, it was found that it was due to one brick being left out in the flue. A penny would be a high estimate of the cost of that brick and of the expense of laying it, yet, through the neglect of that pennyworth, £2,000 damage was done, and risk of human life was run. I think there is a moral in this story which each of us can make out if he will.

SOCIETIES

PETROLEUM.

AT the regular meeting of the Engineers' club of Philadelphia held April 2, 1887, Mr. Max Livingston presented a paper on petroleum.

"Petroleum, known and utilized to some extent in different parts of the world since the dawn of history, was found to exist on our continent in 1627. About a century later the first mention is made of its existence in the now famous oil regions of Pennsylvania, where, until 1850, petroleum was collected from the surface of streams and pools in small quantities for medicinal purposes.

"The introduction of shale oil from Scotland directed the attention to our natural oil, and the practicability of its conversion into a purified illuminating oil was readily demonstrated.

"With the increasing demand the problem arose how to increase the production, which was solved by the late E. L. Drake, who, beginning to sink the first artesian oil-well in June, 1859, 'struck oil' the following August at a depth of 70 feet.

"The production of the Pennsylvania oil fields, which, during the year may have reached 2,000 barrels, did not fall below 20,000,000 barrels since 1879, and attained the enormous amount of 31,784,190 barrels in 1882."

Touching upon the geological question and the probable formation of the different oil sands; ventilating the different theories of the origin of petroleum; calling attention to the wide difference in the quality of the crude oil produced in different districts, and noting the gigantic pipe-line system, the speaker comes to the refining of petroleum, upon which he dwells at some length, describing the necessary apparatus, and explaining the process of manufacture of the different products, their uses and attending danger, emphasizing that, for safety and brilliancy of light, clean lamps and clean burners and *soft, loosely-woven wicks* are indispensable.

Discussing the question of petroleum as fuel, it is shown that even with the burners as now in use, which are far from perfect, it would, under many conditions, be found economical to substitute oil for coal.

In conclusion, our strongest competitor, the Russian oil, receives attention.

"Large as the production of oil in the United States is, it is eclipsed by the enormous production of Russia, which would make competition on our part in some of the most important markets of the world impossible, were it not mainly for two reasons, to wit: the superior quality of our oil, and the powerful, sagacious, and economical management here. The Russian oil has a much heavier specific gravity than ours, and produces but little naphtha, while our oil yields from ten to twelve per cent of this desirable material.

Russian refiners obtain only thirty per cent of illuminating oil; we produce upwards of seventy-five per cent. Last, but not least, the residuum from our crude oil is rich in paraffine wax, whereas the Russian oil produces none.

"But all these advantages do not allow us to rest on our laurels. The proximity of the Russian fields to important oil-consuming centres makes the Russian oil a constant menace, which will increase with the increasing facilities for transportation. Within the last year there has been considerable talk of laying a pipe-line (for refined oil) from Baku to the Black Sea — a distance of about 600 miles. Such a line would certainly lessen the difficulties of transportation. The present state of the petroleum trade, and the prospects for the near future, however, do not justify the consummation of the scheme, which is said to require $10,000,000. Under much more favorable circumstances than those now existing, capitalists could not expect any compensating dividends on their investment."

NATIONAL ASSOCIATION OF BUILDERS.

To the Master-Builders' Association of Boston, and all others interested.

The National Association of Builders of the United States of America was formed at a convention held for that purpose, in the City of Chicago, Ill., on the 29th, 30th and 31st of March last. At this convention twenty-six of the principal cities of the country were represented by delegates from their respective Builders' Exchanges, and after the adoption of Constitution and election of officers the convention adopted the following

DECLARATION OF PRINCIPLES:

"1. This Association affirms that absolute personal independence of the individual to work or not to work, to employ or not to employ is a fundamental principle which should never be questioned or assailed: that upon it depends the security of our whole social fabric and business prosperity, and that employers and workmen should be equally interested in its defence and preservation. While upholding this principle as an essential safeguard for all concerned, this Association would appeal to employers in the building trades to recognize that there are many opportunities for good in associations of workmen, and while condemning and opposing improper action upon their part, they should aid and assist them in all just and honorable purposes. That while upon fundamental principles it would be useless to confer or arbitrate, there are still many points upon which conferences and arbitration are perfectly right and proper, and that upon such points it is a manifest duty to take advantage of the opportunities afforded by associations to confer together, to the end that strikes, lockouts, and other disturbances may be prevented. When such conferences are entered into, care should be taken to state clearly, in advance, that this fundamental principle must be maintained, and that such conferences should only be competent to report results in the form of resolutions of recommendation to the individuals composing the various organizations participating, avoiding all forms of dictatorial authority.

"2. That a uniform system of apprenticeship should be adopted by the various mechanical trades.

"That manual-training schools should be established as a part of the public-school system, and that trade night-schools should be organized by the various local trade organizations for the benefit and improvement of apprentices.

"3. The Association recommends all its affiliated associations to secure as soon as possible the adoption of a system of payment 'by the hour' for all the labor performed other than 'piece-work,' or 'salary-work,' and to obtain the coöperation of associations of workmen in this just and equitable arrangement.

"4. That all blank forms of contracts for building should be uniform throughout the United States. That such forms of contract, with the conditions thereof, should be such as will give the builder, as well as the owner, the protection of his rights, such as justice demands. That whenever a proper form has been approved by this Association after consultation with the American Institute of Architects and the Western Association of Architects, we recommend its use by every builder and contractor.

"5. The Legislatures of the various States should be petitioned to formulate and adopt uniform lien laws, and every organization represented in this association is recommended to use its best endeavors to secure the passage of the same.

"6. Architects and builders should be required to adopt more effectual safeguards in buildings in process of construction, so as to lessen the danger of injury to workmen and others.

"7. We recommend the adoption of a system of insurance against injuries by accident to workmen in the employ of builders, wherein the employer may participate in the payment of premiums for the benefit of his employés. Also a system securing the payment of annuities to workmen who may become permanently disabled through injuries received by accident or the infirmities of old age."

All of which is respectfully submitted,

LEANDER GREELY,
IRA G. HERSEY,
J. ARTHUR JACOBS,
WILLIAM LUMB,
JOHN A. EMERY,
FRANCIS HAYDEN,
WM. H. SAYWARD,

Delegates to Convention from The Master-Builders' Association of Boston.

NOTES AND CLIPPINGS

SUGAR IN MORTAR. — In reply to inquiries as to the use of sugar in "chunam" (the marble-like coating of Indian rooms) and in ordinary mortar, a correspondent in the Ganjam district of the Madras Presidency kindly informs us that the natives rarely use sugar in mortar for building purposes, but they use a highly-prepared mortar for plastering walls, ceilings, and veranda pillars, which takes a high polish and makes a capital imitation of marble. It will stand washing with soft-soap water, and is composed of the following: 100 pounds good slacked shell lime, 1½ pounds country sugar (cheeney), the white and yolks of 16 eggs, 4 pounds good butter-milk, 25 pounds well-sifted, cleaned, fine sand, 1 pound butter, 50 pounds water. These articles must be well mixed and placed in a covered tub and allowed to remain so for three days before using. If this marble mortar could be tinted, it might be very useful in the inner walls of English houses, and in its white state it would come in for ceilings. Washable walls and ceilings of a permanent character are a great desideratum in this country for sanitary purposes, and especially in our smoky towns. Our correspondent gives the following composition as having been used for ordinary building purposes, and found very serviceable: 120 pounds lime, 240 pounds sand, 2 pounds Jaggery sugar, water in proportion. — *Produce Markets Review.*

HORSE-POWER. — A horse-power is a unit of power established by James Watt to be equivalent to a force of 33,000 pounds acting with a velocity of one foot per minute, which is the same as a force of 550 pounds acting with a velocity of one foot per second; that is to say, one horse-power is 550 foot-pounds of power or effects, or 11 man-power of 50 effects each. The product of any force in pounds, and its velocity in feet per second, divided by 550, gives the horse-power in operation. In Watt's rule for horse-power is given a velocity of only one foot per minute, which is equal to 0.2, or one-fifth of an inch per second — about the velocity of a snail. The force corresponding to this velocity is 33,000 pounds, or about 15 tons, which is too large for a clear conception of its magnitude, and a horse can never pull with such force. A horse can pull 550 pounds with a velocity of one foot per second, which is the most natural expression for horse-power. This expression is used on the continent of Europe as follows:

Countries.	Terms.	Eng. trans.	Units.	Eng. equiv.
English	Horse-power.	Horse-power.	550 foot-pounds.	550 foot-lbs.
French	Force de cheval.	Force-horse.	75 kilogr. metres.	542.47 foot-lbs.
German	Pferde krafte.	Horse-force.	513 Fuss-pfunde.	542.25 foot-lbs.
Swedish	Hast-kraft.	Horse-force.	600 skalpund fot.	542.06 foot-lbs.
Russian	Syl-lochad.	Force-horse.	550 Fyt-funt.	550 foot-lbs.

— *The Lumber World.*

A CORPORATION'S LIABILITY UNDER ITS INVITATION FOR DESIGNS.— Architect Thomas Walsh, of St. Louis, has placed the architects of this country under a lasting obligation to himself, for contesting, single-handed and alone, with a wealthy corporation the principle that promises made by the promoters of a competition constitute a valid contract which the courts can and will enforce. This litigation has covered a period of three years, and was carried up to the Supreme Court of the State, which has rendered a decision sustaining the plaintiff in every particular. The facts are briefly these: In April, 1883, Mr. Walsh received a letter from the St. Louis Exposition and Music Hall Association, inviting him to submit plans for a building to cost $400,000, in competition with other architects, on certain specified conditions. One of these conditions was that certain designs, selected as superior to the rest, should be premiated in the sum of $500 each, but that "the architect who is successful shall not receive $500, but he shall be engaged as architect and superintendent, and shall be paid for performing such duties, the usual commissions as adopted by the American Institute and the St. Louis Institute of Architects." Mr. Walsh notified the committee, in writing, of his acceptance of their invitation, and at the proper time and place he presented his drawings, according to the instructions given. His design was pronounced the best of all submitted, but after considerable delay and negotiation with various parties, the directors decided not to engage Mr. Walsh as their architect and superintendent, but to employ one architect to make plans according to their instructions, to engage another architect to make the elevations and to intrust the superintendence to a building contractor who had secured their confidence. Mr. Walsh testified that he offered to perform the duties of architect and superintendent, and declined other business in the expectation that the Exposition work would engross all his attention. The Association having refused so to employ him, he sued for five per cent on $400,000, amounting to $20,000, and was completely successful, the Court of Appeals and the Supreme Court both sustaining his plea. The defense set up by the St. Louis Exposition Association was, that their proposal had no binding force on them at all, being general and not addressed to any particular individual, and being "without consideration," also, that their invitation to competitors was "so indefinite, uncertain and ambiguous that it can furnish no intelligible and certain basis for a contract." But the courts ruled that general proposals become particular as soon as their conditions are complied with by any one, that the amount of time and skill applied by plaintiff in preparing his plans was as truly a "consideration" as anything else, and was amply sufficient to establish a contract, also, that there was no questioning the interpretation which the Exposition directors intended that competing architects should place on their artfully-worded invitation, and such meaning would be sustained by the courts in the interest of public morals. Quoting Lord Mansfield on interpretation of contracts, it was ruled that "the basis of all dealings ought to be good faith." — *Inland Architect.*

THE AMERICAN EXHIBITION BUILDINGS AT EARL'S COURT, ENGLAND. — The works on the buildings of the American Exhibition of the Arts, Industries, Manufactures and Products of the United States, which are

being erected on a large area of land, nearly twenty-three acres in extent, between the Earl's Court and West Brompton stations of the Metropolitan District Railway, are being very actively proceeded with, upwards of one thousand artisans and laborers being at present engaged on the works. For the varied purposes of the Exhibition, several buildings, distinct from each other, are in course of erection. The main building is situated at the extreme western boundary of the site, running northwards in the direction of Earl's Court from its principal frontage at West Brompton, near the West Brompton station, and approached from Lillie Bridge Road, close to the locomotive works of the District Railway. This building is 1,230 feet long and 120 feet wide, covering an area of upwards of 125,000 feet. Its elevation in the Lillie Bridge Road is faced with Portland cement. The chief business offices in connection with the exhibition are on the east and west sides of the frontage. Immediately to the west are separate buildings, one forming a dining-room 250 feet long and 90 feet wide, and the other an art-gallery 160 feet by 80 feet. The whole of these three buildings are fast approaching completion The height of the main building to the apex of its angular roof, which is being covered in with corrugated-iron and glass (the sides also being in corrugated iron), is upwards of 60 feet. The flooring is considerably advanced towards completion, and it is expected that this main section of the exhibition buildings will be ready for the reception of exhibits in about a fortnight. Amongst the numerous other structures which are in progress are several pavilions and sheds at different points on the ground, and the attractions of the exhibition will likewise include a theatre on the northwest side of the ground. On the northeast side, between four and five acres have been appropriated as an open-air encampment, which is intended to be utilized as a hunting-ground, where scenes illustrative of the "wild West" and prairie life will be given. On the south side of the encampment an immense grand stand has been erected. The ground in front of the stand will be formed into a race-course over a third of a mile in length. This encampment fills a triangular space, having on one side the West London Railway from West Brompton to Addison Road, and on the other sides of the triangle the district line from Earl's Court to Hammersmith, and the district branch from Earl's Court to West Brompton. The encampment, as well as the exhibition grounds generally, will be approached from Earl's Court station, in addition to the Lillie Bridge Road approach, by four bridges at different points on the District line. It may be added that a considerable portion of the space is being formed into colonades, divided, in American fashion, into "First Street," and so on in succession up to "Tenth Street." The works and buildings have been designed by Mr. O'Driscoll, who is acting as engineer to the exhibition commissioners, and are being carried out by the commissioners' own workmen. — *The Builder.*

The Temperature of Dwelling-Rooms. — Dr. D. Benjamin, of Camden, N. J., has made some observations regarding the subject of the varying temperature of our dwelling-rooms, which will be found of much practical importance. Every one knows in a general way that the air of rooms is colder near the floor and near the windows, but the very exact differences of temperature as obtained by Dr. Benjamin are very striking. For example, in a room 10 feet high, 12 wide and 20 long, with a good stove and steady fire, the temperature in the centre was found to be 78° Fahrenheit; 4 feet from the window it was 70°; 1 foot from the window 54°, and at the window 40°. At the height of the head the temperature was 75°, at the floor 50°, a difference of 25°. At the ceiling the temperature was 90°, when the temperature at the height of the head was 80°. The fact that the temperature of dwelling-rooms varies so widely explains, no doubt, the frequency with which young children, and even adults, take cold in the house. A child sitting on a nurse's lap in a temperature of 70° gets down and plays on the floor in a temperature 10 or more degrees lower, or runs to the window, a change of 20 or 30 degrees. The habit which ladies have of wearing slippers or light shoes in the house is the cause of many troubles, for these same reasons. The temperature of a room should be about 70° Fahrenheit. The hot furnace-heated houses of our cities cause a vast deal of nervous and respiratory trouble. The thermometer should be hung at about the height of the person's head, and, of course, not near the window or the stove. — *The Medical Record.*

A Peculiar Cause of Fire. — A peculiar fire happened in a suburb of Boston lately, and but for its timely discovery and extinguishment would have been added to the list of fires from "incendiarism," "defective flue," "rats," or any of the causes attributed where nothing is known of the cause. The lady of the house was going out to call, but heard a noise in the upper part of the house just as she was about to shut the outside door behind her. After some hesitation she re-entered the house, went up stairs, and found the chamber carpet burning quite briskly. Upon its extinguishment it appeared that the breeze from an open window had blown the match-safe from the bureau to the floor, broken it, and lighted the matches. We have heard of one similar case. It is the old moral: "Be careful with matches." — *Boston Commercial Bulletin.*

Artesian Wells in Tunis. — Southern Tunis is being transformed by Captain Landais, who is continuing the scheme of the late Captain Roudaire for an inland sea. The artesian wells now being sunk by him yield a large quantity of water, which is utilized in agriculture by the natives who collect round these new oases. Gardens are being created where, till recently there was nothing but sand, and avenues of trees are growing which will one day be bordered by houses. In a few years, if the operations are continued, the whole region will have been converted from a desert into a garden. — *The London Times.*

TRADE SURVEYS

Business throughout the country has been more or less interrupted and disorganized by the new and somewhat arbitrary freight rates which have taken the country by surprise. Public sentiment is rapidly undergoing some sort of a change in regard to this law, but it is too soon to state what the verdict will be. Apart from this element of uncertainty, business is good and prospects are bright. The manufacturing interests of the country as well as the building-material interests are forging ahead as if nothing were wrong. Manufacturers and builders know that there are urgent requirements, altogether legitimate, and that these requirements must be and will be filled. Taking the country all through, production is increasing rather than declining. The industries, large and small, are to-day more actively engaged than a week ago, or than a month ago. Demand is held in check in several industrial channels, but this very fact rather strengthens than weakens confidence, although it has created a laxity in prices. It is to be noted that where slight concessions have been made in several industries the volume of business has not increased correspondingly. The general sentiment in trade and commerce is that prices are not abnormal, and there is nothing to gain by a retrogression in values. There is no attempt made on the part of producing interests to crowd up prices, nor on the part of consumers to crowd them down. Values are as steady and the expanding demand in all directions furnishes assurances, if they were needed, that fluctuations, if any, will be within very narrow limits. Architectural and building authorities all over the country furnish much additional interesting evidence this week of an increasing activity in building operations. Encouraging evidences are furnished, especially in the West, where railroad building is being pushed ahead, even at this early period. The distribution of merchandise East and West during the past two weeks has been very large. The new railroad rates throughout the Northwest are in favor of the lumber manufacture, and a great deal of lumber is being moved in all directions. It is to be particularly noted as bearing on the lumber question, that a good many architectural implement-manufactories are to be erected in the States of the Northwest this season. Besides this feature, the projection of mills, furnaces, shops, and foundries show that great manufacturing activity is assured. In Eastern cities, notably in New York, this year's building operations will be exceptionally heavy. Real estate continues active in all cities East and West, and recent authoritative statements show that in a number of manufacturing towns house-building is to be entered into on a large scale, in which manufacturers, land-owners and lumber-dealers are combining. Lumber of all kinds is firm in prices, and this fact rather stimulates than weakens prices. City real estate will not, in a general way, advance in value in the same proportion that suburban real estate will be improved, because of the evidently growing tendency of small manufacturers as well as large to avoid the increasing taxations and expenses of city locations.

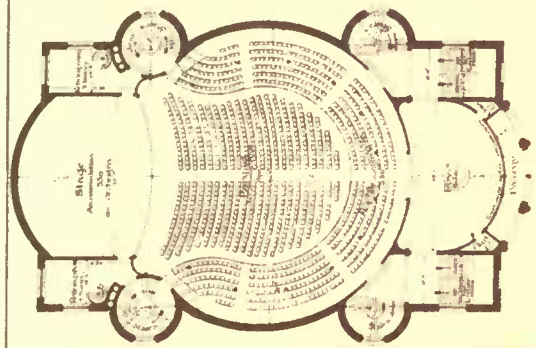
The iron trade has been quiet, but there is every reason for predicting a revival of demand that will strengthen prices. Since the first of the year the increase in the weekly production of anthracite and bituminous coal has been nearly 13,000 tons per week.

The arrivals of foreign material at the three principal Atlantic ports have been large, especially for the last two or three weeks, but the markets, at home and abroad, have not been favorable to the placing of much business on the other side. Railroad-builders are much concerned at the oversold condition of American mills, and are only awaiting a favorable turn of the tide to place large orders abroad. All manufacturers of building-material, from railroad-material down, have the assurances of a heavy and continuous demand. The brick-makers are crowding their capacity, which, in not a few cases have materially improved. The threatened strike at Philadelphia has been adjusted. Brick-making machinery is in active demand. Manufacturers of all kinds of glass — plate, skylight and window — have made a sort of canvass of the country's requirements, and are satisfied that the producing-capacity will not result in a weakening of prices. The threatened difficulty at Pittsburgh will be adjusted by arbitration. The manufacture of artificial products in stone and lumber and the marbleizing process are increasing. This season's slate output will be the heaviest known. The saw and planing mills, and the works turning out wood-working machinery, as well as the carriage and wagon works, are, with an occasional exception, starting in under better auspices than ever before. In some quarters a good deal of complaint is made about cutting competition, but no practical harm seems to result. Judging the condition of the industries by their expanding tendencies, it can be safely asserted that all of them find sufficient encouragement to enlarge their output in the face of the small margins. A summary of all the leading commercial facts and indications of the past week justifies the statement that the country is gaining in confidence in the soundness of the commercial and industrial foundation. The consumptive capacity of the country must expand. The export trade will exercise a favorable, though minor influence. All of the staple products of the country are in good demand. The leading products of the Northwest and Southwest are in moderate supply in all distributing centres. Wool is inactive and depressed. Cotton is strong and active. Coal is dull, though there will be a reviving demand next week, from present indications. Trade, manufacturing, and railroad combinations of one kind or another continue to multiply. As an instance of railroad combination reference may be had to the virtual establishment of a pool in anthracite last week. The trade combinations which have been effected through the winter will, no doubt, accomplish some good in steadying values and in enabling manufacturers to guard against overproduction. There is, beneath the surface of trade, evidence of an increasing cohesiveness, having for its object a conservative control over competition, which, under the feudalism of our past industrial growth, resulted in destructive competition. The few strikes that have recently taken place have been mild and well mannered. Labor is receding gently from some of its advanced and radical positions. The Supreme Court of Connecticut has recently given a hint which will not be lost on the labor organizations. The courts in other States are one after the other defining the rights and duties of employers. Out of all this seems to be growing a more conservative feeling and a desire to profit by arbitration. Employers are discovering that they can arbitrate to much better advantage after they have effected a thorough trade organization. Labor has been encouraged to strike and agitate during the past year or two largely on account of the comparatively defenceless position of employers. The inducements to trade-unionism are likely to decline in force during the next two years through the operation of natural causes. Much political action will be taken by existing political organizations to meet all just demands of labor. European immigration will control the value and price of labor on this side largely. The inevitable recurrences of industrial depressions will be a third factor which will equalize things in the long run. All these and some other tendencies are working to give labor a fixed value, or rather a fixed ratio with the results of labor, taking one year with another. Those employers who are apprehensive of the growth of an arbitrary power on the part of labor will be agreeably disappointed. Just now, in the transition period, the staggering of the blind giant may make it appear as though a mighty power was being placed in his hands, but it is not so. An improved method for determining the value of labor is simply being evolved, and when the evolution is completed there will be less occasion for trade-unionism, strikes, or arbitration.

American Architect and Building News, Apr. 30 1887.

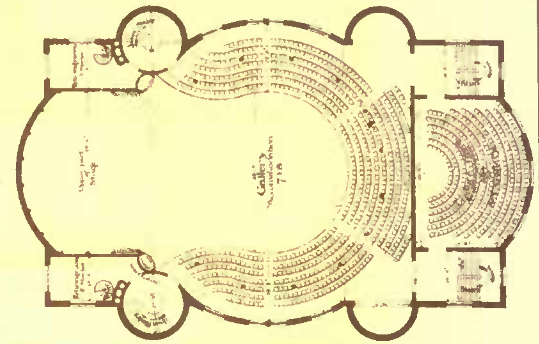
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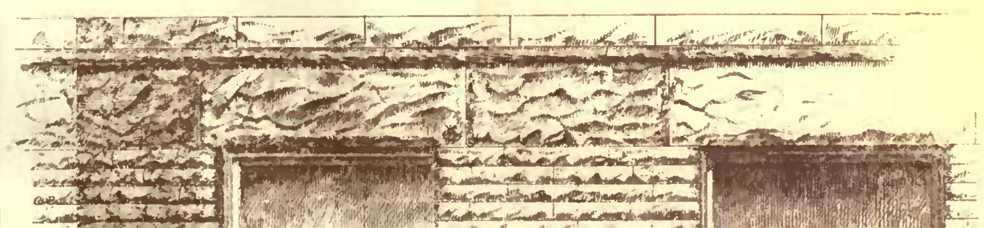


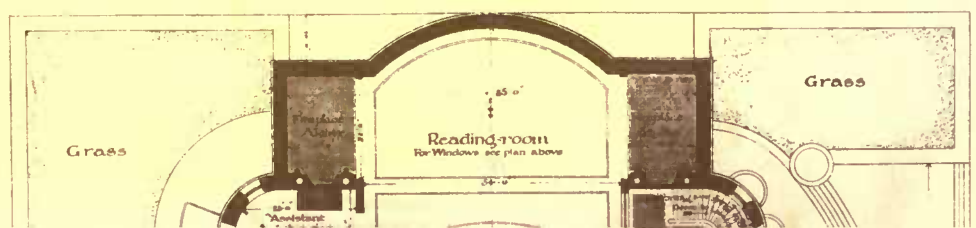
SECOND FLOOR PLAN

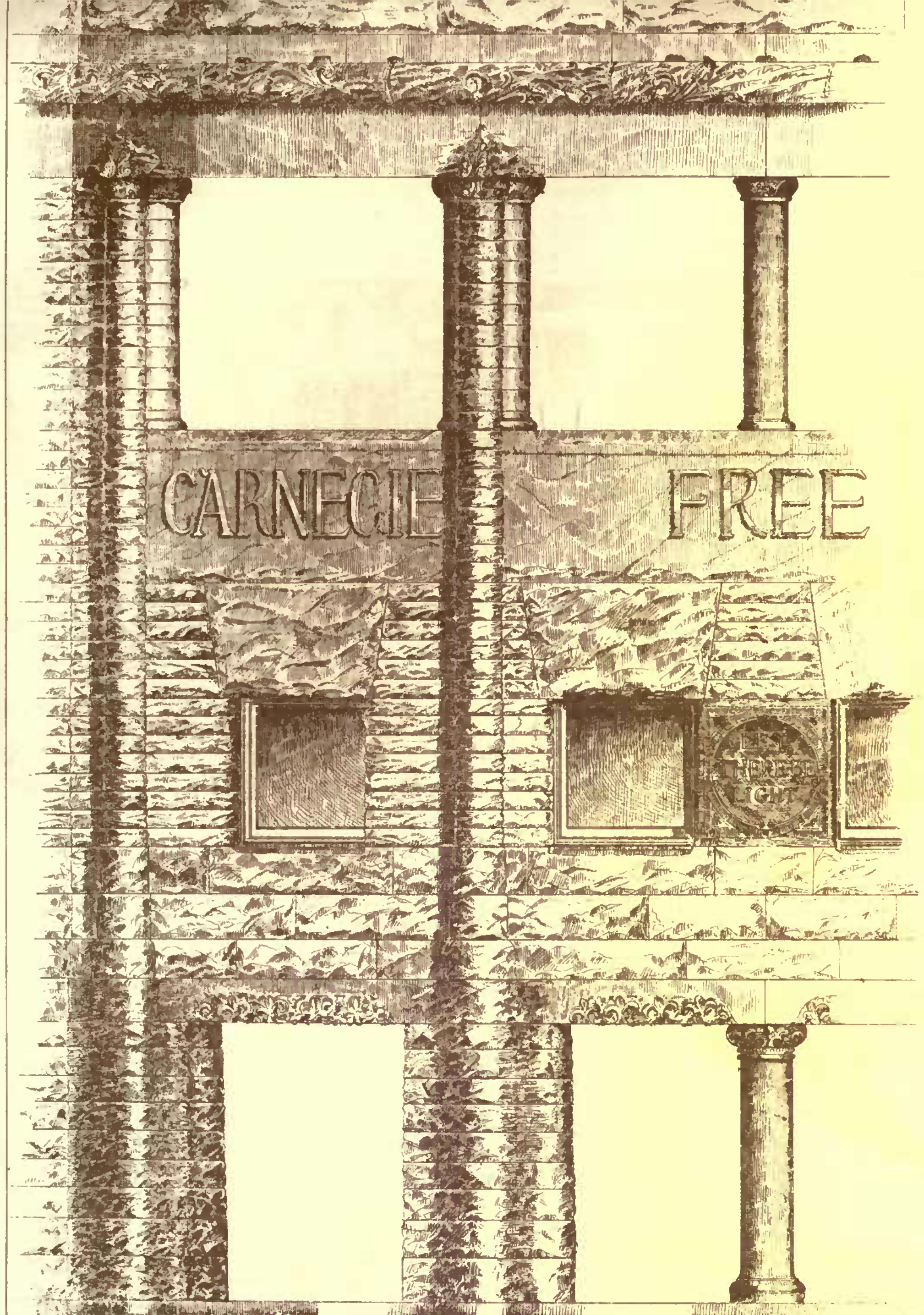


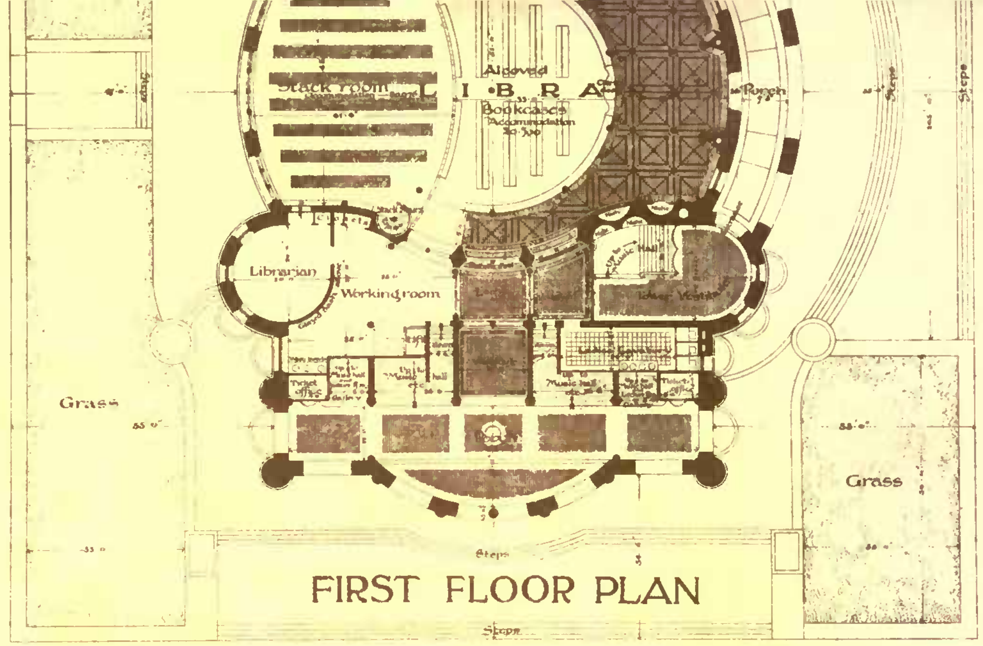


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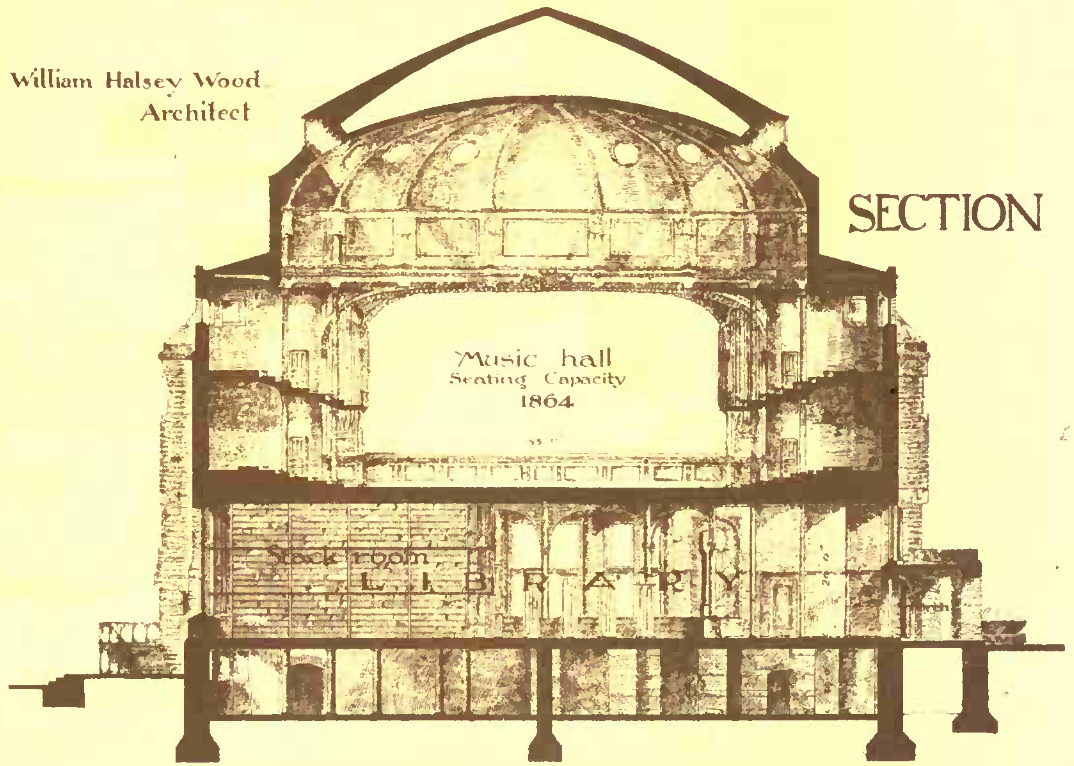






FIRST FLOOR PLAN

William Halsey Wood
Architect



SECTION

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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APRIL 30, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

THE city of Worcester, which lies inland, on a small stream, has for some time been considering the matter of a better system of sewage disposal than that now in use. At present, all the sewers of the town discharge into the Blackstone River, very much to the detriment of the people who live on the banks of the river below; and so much complaint has been made that probably nothing but the disposition of the city authorities to adopt some method of keeping the sewage out of the stream, as soon as a satisfactory one could be found, has prevented the exercise of the authority of the State to compel it to do so. The City Engineer, Mr. Allen, who seems to be quite worthy of the very high reputation which the New England city engineers, as a class, have acquired, was some time ago commissioned to study the subject, and devise a scheme of disposal; and his report has just been presented to the city authorities. The situation of Worcester, on rather high ground near the head of a fertile valley, naturally suggests a system of irrigation, and Mr. Allen has taken special pains to see if this would really be the best mode of disposal. After much study and comparison of facts, he concludes that it would not be the best, for reasons which are stated at length. One of the most important of these is found in the difficulty of purifying the sewage in winter. It is usual for writers on the subject to quote the example of Dantzic, where the sewage of a large city is spread by broad irrigation over a tract of land which never freezes, but continues all the year round to absorb and purify the liquid, as an example of the efficacy of surface irrigation at all seasons in the coldest climates. Mr. Allen says, however, that, although Dantzic is nearly eight hundred miles north of Worcester, and has an average temperature for the year somewhat lower than that of Central New York and Massachusetts, the average winter temperature is much higher; and a sewage-farm in Worcester County, at a season when one in Dantzic would be quite free from frost, would be covered with a sheet of ice, and therefore useless for purifying purposes. As an illustration of what might be expected, he describes the appearance of the Pullman sewage-farm on the occasion of a visit which he made to it in January. As he says, he found the entire surface of the farm frozen solid, and the sewage passing over it unpurified. This might do for Pullman, where, in his opinion, the profit to be made from the farm is the most important consideration, and the purification of the sewage is only secondary, but it would not answer for a large city like Worcester, in providing for which, as he also suggests, a much greater rainfall must be included in the calculations than is known in any large town in the north of Europe; and he concludes that the method of disposal offering the greatest advantages, with the least disadvantages, is that of chemical precipitation. The cost of the tanks, lands, buildings and pipes necessary for this purpose he estimates at about one hundred and fifty-three thousand dollars, which is certainly moderate for a city of fifty thousand inhabitants; and he considers that the cost of the process of purification will be about twenty-two thousand five hundred dollars a year, from which would be deducted whatever revenue might be obtained from the sale of the sludge. The principal considerations in favor of this scheme of disposal, which Mr. Allen sums up very clearly, are, that the cost of the plant will be less than that of an irrigation system; and the effluent will at all seasons be pure enough to conform to the requirements of the law in regard to the pollution of rivers, while the effluent from a frozen irrigation field would inevitably be so foul as to render the city liable to legal penalties; and if improvements should be made in irrigation, so as to make it desirable to adopt that system, the precipitation plant could be converted for this purpose, at small expense; while, in the particular case of Worcester, it should be remembered that the evaporation from an irrigation-field, which amounts in summer to about one third the volume of liquid poured upon it, would detract materially from the quantity of water flowing through the Blackstone River to the mills below; and although the proprietors of these mills might prefer to have clean, instead of foul water to turn their turbines, the quantity would be more important to them than the quality, and the city, by maintaining an irrigation system, would lay itself open to claims for damages on this account, which would not be incurred with precipitation processes, which would transmit the purified water with undiminished volume to the outfall. Altogether, the report is a most interesting and important one, creditable alike to the engineer and to the city authorities, who had the good sense to leave the question in the hands of a man known to be thoroughly competent to deal with it, and familiar with all the aspects of the case, instead of collecting at great expense the perfectly worthless lucubrations of a commission of amateurs, or hiring some celebrated expert to come from a great distance, spend a few hours in driving about the town, and write, mainly from inspiration, an oracular report on the whole matter.

THE *California Architect* reports the death of Mr. Levi Goodrich, one of the oldest and best-known architects in California. Mr. Goodrich was born in New York in 1822, and studied architecture in the office of his father, who was practising in that city, until 1849, when he joined the throng of emigrants to the land of gold. Before he left the vessel in which he reached California, he was engaged to take charge of the erection of a somewhat important building in San Francisco. He soon, however, left San Francisco for the Southern part of the State, and established himself at San José, where he spent the remainder of his life in successful practice, being entrusted with a large proportion of the most important buildings in that part of California. He was able to spare time, in the midst of his active career, for two visits to Europe, for study and pleasure, and was always deeply interested in professional matters, being one of the most prominent members of the San Francisco Chapter of the American Institute of Architects.

A GREAT competition is announced in France, for designs for a monument, or monumental building, to commemorate the French Revolution. The structure, whatever it may be, is to occupy the space where the Tuileries lately stood, together with the ancient court-yard of the palace, as far as the arch of the Carrousel; and an extraordinary degree of liberty is allowed to competing architects, to make the monument almost what they wish. According to the programme, the design may consist of one building, or of several, connected by porticos or galleries, or isolated, and the most important portion may be either a purely symbolic composition, or a building divided into rooms, in which to display, under cover, the creations of pure art working under the inspiration of the given theme. It is intended to spend about two and one-half million dollars on the structure, and this ought to be enough for a work worthy of its unrivalled situation. Framed on each side by the remaining terminal pavilions of the Tuileries, at a distance sufficient to prevent them from interfering with its effect, the monument will have a certain air of reserve, which will rather add to its dignity, while its interest will be heightened by the way in which, if well managed, its beauties will be gradually disclosed from behind the pavilions, as one approaches it from either direction along the new Rue des Tuileries. The distant

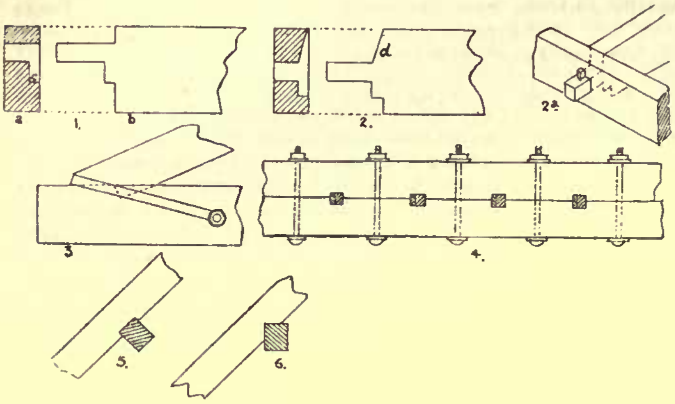
view of it will be somewhat different from any of the nearer views, but this ought to be the finest of all, since it will close one end of the renowned vista which terminates at the other end in the Arc de l'Etoile. Even the great sum intended to be spent upon it will hardly be sufficient for the erection of a building to compete in size with the gigantic Triumphal Arch, but a good deal less would answer for a much more artistic composition, and with the wings of the Louvre for a frame, and the garden of the Tuileries for a foreground, the new monument may, and probably will, present one of the most beautiful sights in the world. Naturally enough, the competition is restricted to French architects. There would be a sort of sacrilege in any attempt of foreigners, who are usually brought up to regard the name of the French Revolution as a synonym for all kinds of bloody excesses, to meddle with an attempt to symbolize by art the pure and noble enthusiasm which, as Frenchmen well remember, characterized its early days; and we hope that a subject so peculiarly French may serve to inspire a work as conspicuous in the history of architecture as the movement which it recalls has been in the history of the world.

ACCORDING to M. Viollet-le-Duc, many of our most efficient modern devices for the improvement of building materials and methods are merely re-inventions of things well known in the Middle Ages, and it must be acknowledged that he sometimes appears to be right. It has recently been reported in a number of technical journals that a certain German professor believes, on the evidence afforded by experiments made under his care, that timber which has been long immersed in water is no longer liable to the attacks of dry-rot. The theory on which he accounts for this is that the water slowly dissolves out the albumen and salts contained in the wood, and thus deprives the fungus of the nutriment necessary for its support. This is almost word for word the argument used by Viollet-le-Duc in advocating a return to the practice of water-seasoning invariably used by the Mediævals. As he says, the two years' floating which, even down to the time of Evelyn, was considered an indispensable preparation for structural timber, by dissolving out the albumen, sugar and soluble salts from the sap-cells, leaving only a mass of inert cellulose, not only freed the timber from any tendency to the fermentation by which dry-rot is nourished, but rendered it much less attractive to insects; so that wood seasoned by the ancient method rarely suffers from the borer. It seems probable that the advantages of water-seasoning are particularly noticeable with oak, which, we must remember, was the ordinary framing lumber, even in this country, until within a comparatively recent period; and the floating which most of our spruce lumber gets before it is sawed certainly does not render it invulnerable to dry rot; but it may be that the resinous sap of coniferous woods needs a longer time or a different solvent to remove it, and that a prolonged soaking would convert even that unreliable material into cellulose so inert and unchangeable that, to quote one of the German professor's experiments, sawdust made from it, when buried in damp earth, would "remain in the ground wholly unchanged." We do not know, by the way, whether any scientific person has noticed the difference between various coniferous woods, particularly pine and spruce, in their behavior in contact with the earth in their natural state. In some parts of New Hampshire, where white pine and spruce grow side by side in the forests, it is usual for the farmers, after clearing a piece of woodland, to extract all the stumps of the pine trees, at great expense, by means of a machine hired for the purpose, while the spruce stumps are left untouched. To the uninformed there is something eccentric in this picking out of a few stumps here and there in a field for extraction, but the farmers explain their conduct by saying that in a year after cutting the trees down the spruce stumps will be so rotten that a plough can be driven directly through them, just as if they were so much earth; while the pine stumps never rot, and must be pulled up before the land can be tilled.

ALTHOUGH architects here have a good deal to contend with, they at least escape some of the annoyances which disturb the peace of mind of their brethren in Europe. Foremost among these must be the necessity of accommodating their notions to those of the various sentimentalists in authority with whom they have to deal. With us the architect himself is usually the only sentimentalist concerned in his work; but there he must exert himself to please an unlimited number of archæologists, critics and dilettanti, who by no means agree in anything except their disposition to find fault with him. Those members of the profession who engage in the restoration of ancient buildings have perhaps the hardest time, but they, being sure of pleasing nobody, are perhaps invulnerable to criticism. The *Builder* tells about a certain clergyman who, having charge of an ancient church, was officially remonstrated with by the Society for the Protection of Ancient Buildings, because he wished to add to it an organ-loft and vestry, which, as the Society informed him, would tend "to spoil the church as a mediæval building." If it had been the architect, instead of the rector, who had made the proposition, the Society would probably have added some reflections at his expense; but the profession escaped in this instance. There are degrees, also, of archæological science to be taken into account, as where the same society was informed that an old church had been altered, "with the most reverential attention to the conservation of the ancient building," which had in fact been "conserved" by pulling it all down and using the old materials in the new structure. Another class of deities whom the English architect must propitiate is to be found in the critics, among whom Mr. Ruskin stands easily first. The other day some incautious Christians, who had built a cheap mission chapel in the suburbs of London, applied to this great man to help them pay for it. Instead of money they received some advice, of greater value, probably, than any pecuniary gift that the critic could bestow. "Why," he asked them, "did they build churches that they could not pay for?" "Why did not they preach behind the hedges, rather than run into debt?" "And of all manner of churches thus idiotically built," he was kind enough to add, "an iron church was to him the damnablest." Mr. Ruskin is said to have just joined the Roman Catholic Church, and this may account for his asperity in talking to evangelical Protestants; but the story shows how cautious one must be in dealing with such persons.

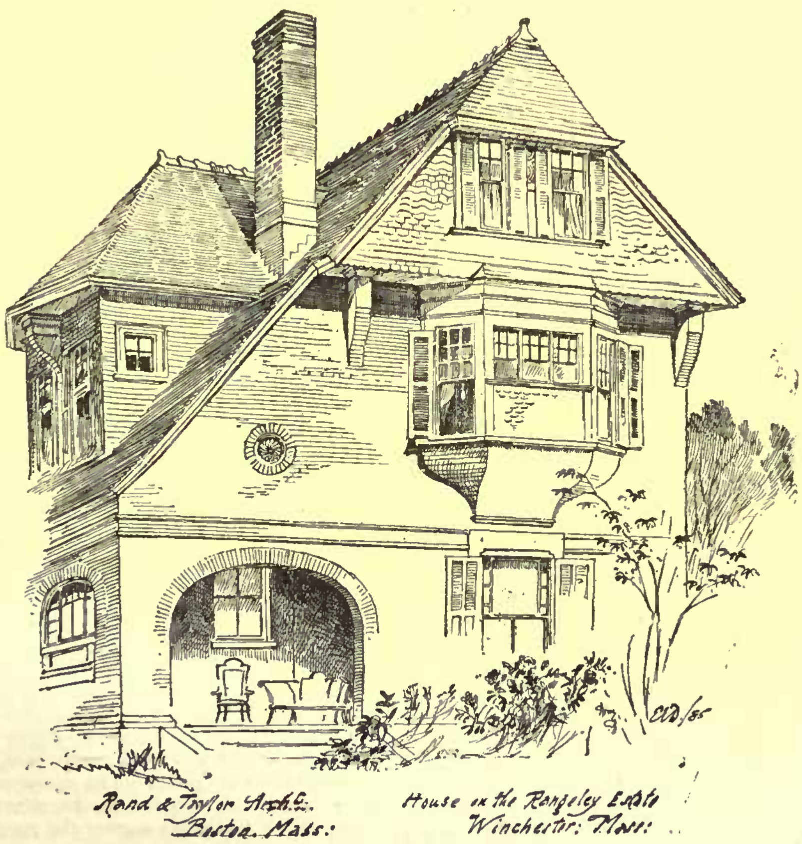
EVERY one is interested in the progress of the art of blowing up one's fellow-men, and the names of the mysterious explosives known as melinite, roburite, and so on, are familiar to all who read the newspapers. At present, the German Government appears to have adopted roburite as the most suitable substance for demolishing Frenchmen, and is laying up great stores of it for future use; while the French Government thinks it has discovered in melinite a material as destructive to Germans as the roburite is likely to be to its own subjects, and keeps the manufactories where it is made busy night and day in accumulating a vast provision of it for the time of need. As we all know, the French are enthusiastic, while the Germans are phlegmatic; and some of the Gallic ardor for action appears to have communicated itself recently to the melinite, a magazine of which blew up, killing, by mistake, several of its friends. Not to be behind in the race for distinguished destructive position, the Swedish officials have now begun a series of experiments with explosives, and have evolved a compound known as "bellite," which is inexpensive, easily made, and not liable to spontaneous explosion, but which develops, when intentionally fired by a spark, a force thirty-five times as great as gunpowder, and greater by fifteen per cent than that of guncotton. To make bellite, it is only necessary to treat benzine with a mixture of sulphuric and nitric acid. The sulphuric acid should be of the fuming kind, which is nearly free from water; and the proportion of nitric acid should be somewhat larger than that of the other. By keeping the mixed acids in contact with the benzine for some time, at a temperature rather above that of boiling water, the benzine is converted into trinitrobenzine, which is washed, so as to clear away all traces of free nitric acid, and then mixed with nitrate of ammonia, which is the common substance used for producing nitrous oxide gas. The mixture, if the free acid is thoroughly washed away, is very stable. Unlike dynamite, which explodes so readily from concussion that in heavy blasts only every tenth cartridge is fired directly, the others being all exploded with certainty by sympathy, a charge of bellite cannot be ignited by a blow or by friction. A shell charged with it strikes its object without exploding, unless a fulminating fuse is attached to it, and a magazine filled with it may be struck by projectiles without danger. When applied to use, however, its force is enormous. A charge of less than half an ounce, placed in a mortar behind a shell weighing ninety pounds, projected the shell to a distance of nearly four hundred feet, and its efficacy in detaching rock in a quarry proves greater than that of any nitro-glycerine compound.

JOINTS IN WOODWORK.[1]—II.



IN the last paper an endeavor was made to show that the system of wood construction in this country was open to considerable improvement, and more especially in the matter of joints. We will now take one or two other joints which appear to be improperly formed. The most important of these is the "tusk tenon." This joint is so extensively employed, that although it formed the subject of a short paper contributed to a contemporary some time since, it may be again mentioned here. The practice is to frame the joint in the manner shown in Figure 1, which illustrates the header *a* in section, and separated from the trimmer *b*. Taking a joist ten inches deep, as an example, the American framer will measure two inches from the top, will make the tenon itself two inches deep, and will form the bearing surface *c* beneath. This with a wedged key through the projecting tenon completes the joint.

Considering how frequently the joint occurs in all descriptions of buildings, it can be seen that it is of great moment to form it accurately. Beyond this, the weight carried by the header is great comparatively to that carried by the other joists, which increases the importance of accuracy. Considering further that the centre of a beam supported at its two ends, is substantially the neutral axis, it is not difficult to understand that the proper place to pierce the tenon is on that line. An inch cut out of the top or bottom of a beam will weaken it more than two inches cut away from the centre, so that if the tenon be placed higher or lower than the centre, it will do more harm corresponding to the distance. A further source of weakness is the fact of the liability of the tenon to split off under the weight, and to prevent this it is advisable to form the shoulder *d* as shown in Figures 2 and 2 *a*, which represent the exact form of the joint as it may best be constructed, and as it is almost universally employed in Europe, and in some few sections of this country. It is hard to see how the first form can be justified, for, leaving out the shoulder *d*, the labor is the same in both cases, although the strength is decidedly less in the latter.



It is not too much to say that no careful architect will permit the use of this form even in the smallest or most simple building. The shoulder *d* might be omitted, although it adds a good deal to the strength; but the most important thing to assure is that the tenon pierces the header at a point one-half way down its depth.

The effect of shrinkage in timber, and its important bearing upon the form and execution of joints, has already been pointed out. In some positions a joint may be subjected to the effect of dampness: in such cases it must not be forgotten that the effect of the dampness will be the exact reverse of the shrinkage, the timber swelling in precisely the same manner only in the opposite direction to that in which it shrank. In forming all joints subjected to the effect of occasional or periodical dampness, due allowance should, therefore, be made, both for shrinkage and expansion.

Associated with joints is the important question of connections, such as straps, bolts, pins, keys and wedges. Iron straps or bolts are employed to a great extent in connecting rafters, and the principal members of all large framed structures. The various forms in common use will be found indicated in the text-books, so that it is not necessary that special attention should be given to them here. The bolt used for connecting the foot of a principal rafter to a tie-beam shown in the last paper, page 51, is largely used but is objectionable, as it not only weakens both timbers by passing through them, but is itself likely to bend under an unequal thrust: a strap passing around the members is much better. Probably the best connection is that shown in Figure 3. Here the strap supports the rafter in the proper position to resist the thrust, and does not injure the beam as it is pierced through the centre. The joint too, is rendered simpler, and we should be glad to see this joint employed to a greater extent than it is.

Pins are useful connections, and should be used oftener than is customary. In most of the old-time framed structures, which are so well known for their strength and endurance, it will be found that several pins are used in addition to good joints at every connection. Pins are best made of well-seasoned wood (locust and white-oak answer admirably), straight in grain, and of a hard variety.

The use of keys is important, especially in the various methods of joining timber together in the direction of its breadth and length. They should be cut out of the beam in such a way that the shearing strain to which they are subjected acts across the grain. The main use of wedges is to force the parts together, and with this object they are formed with slightly inclined surfaces, and are driven in from opposite sides of the beam. As the shrinkage of keys defeats the object for which they are intended, it is well in all important structures to employ keys formed of metal. Metal, however, in such positions, whether it be straps, bolts or wedges, must always be covered with a material to prevent oxidation. And it is worthy of remark that ordinary paint is not sufficient, unless the metal be in such a position that it may be readily got at, to permit of painting at intervals.

Wedges occur frequently in conjunction with joints, and if properly formed and driven in, constitute an efficient aid. A wedge should be tapered just sufficiently to give an equal bearing on both edges, due allowance being made for the shrinkage of parts. It is of some moment that they should not be sawn out of the log unless a piece of straight-grained stuff is to be had. The proper method is to tear them off from the piece, by which means a straight or even grain will be assured, and the liability of the wedge to split into pieces be removed. Glue is usually employed to keep the wedges in place, but white lead is much better for exterior work, as it will not be affected by the weather.

A point generally lost sight of, in relation with straps, bolts and such connections is that, with the natural shrinkage which takes place, they require tightening up occasionally.

The method shown in Figure 4 is a good one for joining timber in the direction of its depth, but the efficiency of the joint will be lost after a time, by the shrinkage of the timber, if the bolts are not tightened up. Here, and in other cases where bolts are used, a washer should be placed not only under the nut, to prevent tearing up of the fibres of the timber while tightening it up, but also under the head, to prevent its sinking into the wood. The latter is often omitted, but in good work it will never be neglected.

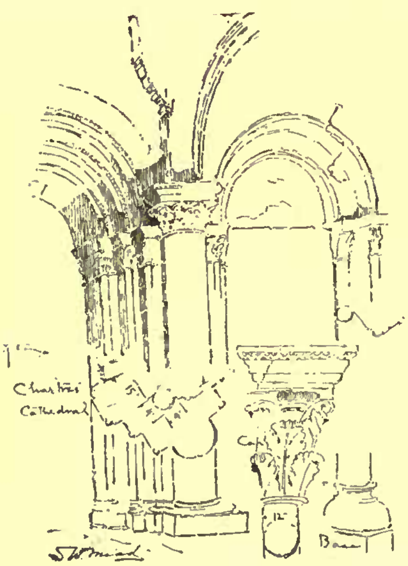
The method of framing purlins in roofs is another striking instance of the extent to which ill-considered construction is employed. Frequently the purlins are framed with the greatest scantling vertical, as in Figure 6, instead of at right-angles to the rafters, as represented in Figure 5. Probably the object is to save the time in the cutting-in of the rafter, for the triangular piece in Figure 6 could be cut out of the rafter in probably a little less time than the notch in Figure 5; but the saving is more apparent than real.

A beam should, broadly, be framed with its greatest scantling at

[1]Continued from page 52, No. 579.

right-angles to the pressure it has to sustain. Thus, in a floor-joist, the larger scantling is vertical. In purlins the pressure or strain is substantially at right-angles to the rafter, and this can be understood when it is remembered that the weight upon the purlin will cause it to bend or sag between its two points of support. The object being to place the greatest depth at right-angles to this pressure, which is in the plane of this curve, the purlins will be placed at right-angles to the rafters. ARTUS.

SKY LINES.



EVERY one who has given much attention to the subject of design, has, I fancy, some one particular canon of taste to which any architectural study must conform in order to be attractive. Undoubtedly, the main requisite in all plans is adaptability to the needs of those who are to inhabit the building, when materialized. Where this condition is not carefully met, no design, however admirable, can possess more than a very general interest. But where the preliminary conditions have all been fulfilled, and the floor plans and general scheme of elevations have been satisfactorily arranged, there still remains a very important point to be considered, and one, it seems to me, that deserves special mention, because it is so often and so completely ignored by both amateur and professional architects. That is the question of sky lines. Next to adaptability it should receive the most careful attention.

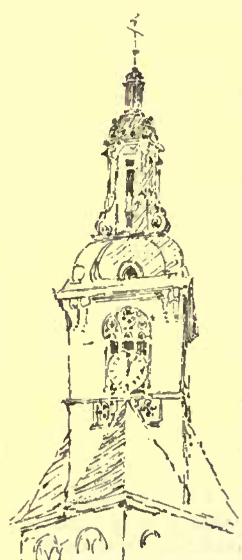
We are all happily more or less near-sighted. In viewing a field, an orchard or a landscape, we do not see the details of their several components. Were this not so, we should be overwhelmed and bewildered by the multiplicity of images. In the very excess of what we saw, we should see nothing. But we are conscious only of lights and shadows, of masses of color against neutral backgrounds, and of groups and outlines. It is from these that our impressions are received. If we analyze our preference for certain trees and shrubs, we shall find that it is seldom the shape of the leaf, or the texture of the bark that decides our choice. It is rather the color, effect and general outlines of the entire plant. Of all the trees that grow, there are few that excel the elm, the beech and the oak in beauty, yet when examined near at hand, their leaves are comparatively coarse and unattractive. In elegance of outline they are decidedly inferior to those of the maple, and still more to those of the bilshed, the delicate curves of which are worthy of more frequent imitation. Nevertheless, a bit of clear sky framed by the tracery of far-reaching elms is a picture in itself.

It is precisely the same with our houses. The impression produced is due to the outline, and the color tone. At any distance one is not conscious of the details and decoration, unless they are excessively striking, and that is always out of taste. The effect is produced by more penetrating characteristics. If the color and grouping of a building are bad, they strike the observer at once, and however beautiful particular features of the structure may prove on nearer examination, he is not disposed to be appreciative, if the first impression has been unfavorable. The value of effective coloring is well understood. At the present day we introduce color into our designs with almost Oriental license. It is not a tendency therefore which needs further encouragement. We require, rather the restraining hand of chromatic discrimination. In our attention to form and outline, however, we have been less assiduous. It is a very rare thing even among expensive buildings, to find perfectly satisfactory sky lines from all points of view. I have in mind now a rather expensive country-house, which was illustrated in a recent issue of an architectural paper. The floor-plans were admirable, and gave a succession of pleasant apartments opening into each other in a way to tempt constant hospitality. The materials had been well chosen, and up to the eaves the arrangement was very effective. But here all exterior beauty ended. The roof had been so badly managed, that no amount of decoration could render the mansion pleasing. In the place of repose, there was a Jack-in-the-box expression, as if the building had popped up from amid its surrounding foliage to take an observation, and might in time be expected to subside. No ingenuity in coloring or setting could appease its look of unsatisfied expectancy or make it harmonize with the landscape. Yet a very few changes, a more careful disposition of lines and angles would have made the design in perfect keeping with its environment and attractive to even the most critical.

The chief fault in the management of the roof lines of this design, and of the host of others which fail so utterly in this respect, is not difficult to find. Some predominating feature to which the others could have been properly subordinated was needed to give it character and dignity. In its absence there was a manifest lack of unity in the composition of the roof, and consequently of the whole house. The several gables, being all nearly of equal dimensions, were confusing, and distracted the attention. There was absolutely no one point upon which the eye could rest with any feeling of repose. In the case of more pretentious buildings, the liability to error is even greater. It is a tradition, handed down to us from the designing of cottage architecture, that a sloping roof is permissible in only one story of the house. In place therefore of an integral design, our larger houses are very apt to assume the appearance of a cluster of smaller dwellings, which might perhaps have been annexed by one of the more prosperous tenants as improved circumstances permitted such an addition to his domicile. This gives a roof, broken up into a succession of unimportant gables, and a sky line which is consequently devoid of either picturesqueness or dignity. In our dry and sunny climate, where ample porches are an essential feature of all country-houses there is another possibility for incongruous results, which should not be forgotten. Where the site is chosen on high ground, and unrelieved by foliage, or where the building is located on a cliff and stands out boldly against the sky, the porches become an important element in determining the outline, and should receive hardly less careful study than the main roof. Whenever possible, it is a great advantage to have some connection between the roofs of the porch and house, or at least some conformity in the angle of slope. Where this can be managed, it removes the otherwise unpleasant suggestion that the porch was an afterthought, and added subsequently to the building of the house.

Judged from our standard of impressive sky lines, it will be found that there are few designs for exteriors which are perfectly satisfactory. But if those who are engaged in architectural work will analyze the effect produced by their creations, they cannot, I think, fail to discover that this single feature determines in a large measure, the effectiveness of any design. HANFORD HENDERSON.

ITALIAN MARBLES.



THE Italian marble trade is of considerable importance. It centres in Carrara. It is calculated that there are annually extracted from the quarries in the neighborhood of this town alone something like 200,000 tons of marble representing a money value of over a million sterling. Upon this the Italian Government takes toll to the extent of £20,000 a year, in the shape of a direct tax of 10 centesimi (a penny) on every cubic palm raised. A palm measures in length 9.81 inches, and is to the Italian quarryman what the foot is to the Englishman. Four cubic feet equal rather more than seven cubic palms, the exact equivalent being 1 to 1.81.

The whole range of the Apennines is singularly rich in deposits of marble; but the white marble found at Carrara, and known all over the world is the most famous. The name Carrara is derived from the Latin *quarrariæ*, whence our English word quarry. The population of the town numbers some 25,000 souls, nearly the whole of whom are engaged in the trade. The people are exclusive; they speak a sort of language or patois of their own, dignified by the name of Carrarese. Human life is not set at so high a value as it might be, stabbing affrays being lamentably frequent; but it is of almost unknown occurrence to hear of mischief to the stranger within the gates. The numerous *studii* and work-shops are like so many cellars built on the street level under the dwelling-houses. They admirably answer the purpose of being shady and cool to work in, but afford no opportunity for the sculptor to display his handiwork. A small stream runs through the centre of the town, and affords the motive power to saw-mill after saw-mill. In the Academy there is a large collection of models and casts from the greatest works in sculpture — ancient and modern. From sixty to seventy pupils, who are taught drawing and modelling, are regularly in attendance.

The marble when brought from the quarries is conveyed to the seashore at Avenza, which is about five miles distant from Carrara. It is sent thence to Leghorn in small coasting vessels called "*navicelli*"; from Leghorn it is exported to all parts of the world. A considerable saving would be effected if sea-going ships could load at Avenza itself. At present there is the cost of transportation to another port, and the consequent double handling. It is quite practicable to make a good harbor; but hitherto local enterprise has contented itself with building a pier, from which the small craft are loaded. A railway connects the pier with some of the quarries; but the bulk of the traffic goes the old way by road, and on bullock wagons. The journey down is a slow and terribly toilsome process. A

team of bullocks takes a whole day to complete a single journey from the quarries to the seashore; the mountain road is more like the bed of a torrent than a beaten track.

The quarrymen are a prodigiously hard-working race of men. In the summer it is too hot for them to work in the middle of the day; but long before the day breaks they commence their ascent of the mountains and climb three, five, and some of them six miles before they reach the scene of their labors. When the sun is high enough to force them to retreat they have done a good day's work, and a long march home in the burning heat is before them. These men earn wages which average some 15*s.* a week; they are paid fortnightly. Not being a thrifty race, a good portion of the scanty wage goes in liquor and the lottery, and nature is kept going till next pay-day on a fare in which a miserable black bread is the principal factor. The men work in gangs. Each gang is under the control of a head man, who agrees with the owner of the quarry to get out the marble at a fixed price per cubic palm. The getting of the marble is dangerous work. The quarries are just so many openings cut in each side of the valleys into the mountains. The blocks are loosened from their beds by the ordinary process of blasting, and are then suffered to slide down by their own weight. As they fall down the mountain side large fragments are knocked off them right and left, and this rough usage is the cause of many of the flaws and vents which are afterwards developed in the working.

On Sundays the market-place at Carrara is a sight to be seen. It is filled with quarrymen from the mountains, sculptors from the *studii*, and country people in picturesque attire from the surrounding villages. In this same market-place there is a statue, said to have been executed by Michael Angelo, during one of his visits to the town. The authorship, however, like a great deal ascribed to the great artist is very doubtful.

The average wages paid to the different classes of workmen are as follows: quarrymen, per day, 2*s.* 6*d.*; gangers or foremen, 4*s.*; masons, 2*s.* 9*d.*; sanders, 2*s.* 9*d.*

Of sculptors there are all grades, from the ordinary carver whose services can be obtained for 3*s.* 6*d.* a day to the master in the art — the professor — who has received rewards and decorations from crowned heads, and who is sought after with commission from every part of the world. The quarries are situated in the ravines or gorges which run up between the lofty peaks of the Apennines. At Carrara these mountains are about 1500 feet in height, and from their summits a magnificent view can be obtained of the plain below, and of the Mediterranean in the distance. The white marbles of Carrara are known to the English market as Sicilian, Vein and Statuary. Of these, Sicilian is the most common. The term "Sicilian" is purely English, and is of doubtful origin; it has been asserted that the first cargo brought to England arrived in the good ship "*Sicilia.*" More probably, however, the marble is so called because it was formerly shipped to Sicily, and thence to an English port. The Italians call it Bianco Chiaro (clear white). It varies much in color and in texture as it approaches more nearly to the character of Vein on the one hand, or of Dove on the other. The principal quarries are situated in groups known as the quarries of Lorrano, Canal Bianco, Canal Chiosa, La Rattola, and Ravaccione, in the ravine of Ravaccione; of Fantiscritti and Canal Grande, in the ravine known by the latter name; and of Collonata.

The pure appearance of white marble has caused it to be much used in the raising of memorials to the dead. For this purpose Sicilian is chiefly employed. It is, in fact, the only white marble which will bear exposure to the open air. The others are much softer and liable to speedy disintegration if placed out of doors. Very great care is, however, necessary in the selection of Sicilian which will withstand a Northern climate; the best is of a slightly bluish tint, of hard and close texture, of uniform color throughout, and free from decided veins. Vein marble is used for decorative purposes in the interior of buildings; it is of much whiter ground than Sicilian, is softer, and becomes more or less valuable as the veining is more or less fine and regular. The principal quarries are those of the groups known as Vara and Canal Piccola, in Canal Grande, and of Gioja, in Collonata,

Statuary needs no description. It is the most beautiful and most sought-after of all marbles. The great difficulty about it is that a block can be rarely obtained which is pure. The principal quarries are in Ravaccione, near Carrara. The best is of even, white tone, with a slightly yellowish tint. Some of it is of a sugary whiteness, which takes the eye of the inexperienced; but is quite unfit for sculpture. Statuary of this description is soft and easy to work; but is very liable to stains, and rapidly falls into decay. A very beautiful description of Statuary is found near Serravezza. It is much whiter than that of Carrara, but is somewhat coarser in grain, and is, perhaps, on the whole, not so well fitted for the sculptor as the latter. Some of the quarries in Canal Grande and Collonata produce a marble of a dark blue tint with veinings, which are little to be distinguished from the ground color. This variety is known in England as Dove marble. It is very hard, and is little used.

A marble of similar character, but of much greater beauty, is known as Bardillo or Bardiglio. It is found at Serravezza. It is of a pale dove ground traversed by dark veins; sometimes the veining assumes the appearance of flowers, hence the Italian name for it of "Bardiglio fiorito," or "fiorito di Serravezza."

Pavonazzo marble is raised near Carrara. It is of very rich color; the ground varies from a creamy white to a yellowish brown, marked with deep purple veins, with here and there a greenish tinge. It is much used for panellings to walls. When employed for this purpose and used in large masses it has a magnificent appearance.

Siena marble is found near the town of that name, the ancient Sena Julia on the Via Clodia. This marble is of a deep, rich yellow tint, with veinings of purple and black. The quarries do not seem to have been properly opened up. They are so many scratches on the side of the mountains, and very few large blocks are produced. In Italy it is usually sold by weight.

The quarries from which black and gold marble is procured are at Porto Venere, near the mouth of the Gulf of Spezia. This marble is sometimes known as "Portor" marble. This is a corruption of the Italian Port d'Oro. The ground is of a rusty black with spots of light brown. The veining is very beautiful, running from white through every shade of yellow to dark brown.

Near the coast between Spezia and Genoa are several quarries of colored marble. At Levonto two varieties are raised — the Rosso and Verde di Levanto. The first is a purplish-red marble; in the latter veins of purple, red and green are mixed and interlaced in a most bewildering manner. At Pietra Lavezzara, near Genoa, the beautiful Genoa-green marble is produced. This marble has a very deep green ground; in places it is almost black. It is filled with veining of a lighter green and white. Another very handsome green marble, known as Verde di Pegli, is found near Genoa, along the course of the Varenna torrent.

A very beautiful serpentine, called Verde di Prato, is quarried near Prato, a small town a few miles from Florence. The ground is of a deep green, with dark spots, and veined with white. It polishes well and is cheap, but it cannot be obtained in large blocks, and it is not the most durable of marbles. A great deal of it has been used in buildings at Florence. It is especially to be noticed in the Cathedral, the Campanile, and the church of S. Maria Novella. In these buildings it has been employed in the exterior walls with alternating courses of white marble and red sandstone. The effect is striking and very beautiful, but much trouble has been caused by the gradual decay of the serpentine. The use of it should be entirely confined to interiors.

There are several quarries of a finely-marked white marble in the hills to the north of Verona, the town immortalized by Shakespeare, in his story of the loves of Romeo and Juliet and the contests between the Montagues and Capulets.

> "Two households, both alike in dignity,
> In fair Verona, where we lay our scene."

The tomb of Juliet is one of the attractions of the place, and it is built of the red Verona marble. This is of a pale pink ground, with veins of red and dashes of gray. It sometimes assumes a brecciated aspect. The marble is not very hard, but it takes a good polish. It has been extensively used in the buildings of Venice. In the palace of the Doges it is found in the columns on the south and west sides; and it has also been employed at St. Mark's, in the Accademia delle Belle Arti, and in several of the Venetian churches.

Near Lago Maggiore there are some quarries of a white marble, which was used in the construction of the beautiful cathedral at Milan. In the same neighborhood, at Baveno, on the shores of the lake, there are some large quarries of a very fine granite; this is principally worked upon the spot, very little being sent away in a rough state.

There are several varieties of Italian alabaster. A very beautiful pure statuary is found in the Val di Marmolago, near Castellina. Another, known as agate alabaster, is quarried near Volterra. A fine clouded variety, called Bardiglio, is also found near this town, which is the seat of the Italian alabaster trade. There is an enormous business done in this material. There is hardly a piece of sculpture of which a model can be obtained, which has not been reproduced by the sculptors of Volterra. So much of it has been turned out in modern times that its value has been sensibly depreciated. It is somewhat fragile, but the beauty of its appearance and the ease with which it can be worked will always keep it in demand.

The stowage of marble, as practised at Leghorn, is raised to the dignity of a fine art. Generations of stevedores have inherited and have improved upon the traditions of their fathers. The loading of the large ocean-going vessels from the small *navicelli* is very smartly done. A floating pontoon crane is brought into play, in which the required power is gained by means of a huge wheel. By this means the heaviest blocks are lifted from the small vessels, and are delivered into the holds of the large craft without difficulty. The cargoes are usually made up with light goods, of which pumice-stone, hemp, oil and sumac form the principal part. Of these, neither hemp nor pumice are sources of trouble, but it is necessary to keep oil and sumac from all contact with marble. Sumac is especially dangerous. It is shipped as a fine floury substance, and in sacks which are never too stout. When sumac dust settles on white marble, the result is not immediately apparent; but if it once becomes wet, or even damp, it becomes a powerful purple dye, which penetrates the marble to an extraordinary depth.

Italian marble is usually shipped and freight paid by measurement, and not by dead weight, twenty-five cubic palms, or about thirteen and one-third cubic feet being reckoned to the ton. The principal market is the American. In one year (1882) there were shipped to the United States and Canada 29,940 tons. During the same year the exports to British ports amounted to 15,760 tons. Belgium, France, Russia and Germany are large importers of Italian marble.

Sawn slabs are principally shipped to England — in fact, this is now almost the only country which admits them duty free. As a consequence, the market price of sawn Italian marble is lower in England than in any other part of the world, except in Italy itself, and sometimes not even with that exception. — *Arthur Lee in Building News.*

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE OF ROSS WINANS, ESQ., BALTIMORE, MD. MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial and Gelatine Editions.]

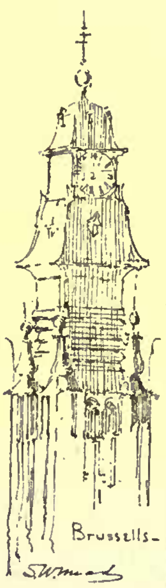
"BREAKING UP OF THE AGAMEMNON." AFTER AN ETCHING BY SEYMOUR HADEN.

FRANCIS SEYMOUR HADEN was born in London in 1818. The son of a distinguished physician, he followed his father's profession, in which he has reached eminence. He etched his first plate in 1843, and has since then produced, in the intervals of his labors as a busy London surgeon, some two hundred plates. Excepting Whistler's, the etchings of no modern artist have gained so much attention as those of Haden, and this although they are the work of an amateur. His most famous plates are "Shere Mill-Pond," "Windsor," "Greenwich," "Erith Marshes" and "Calais Pier" — the last named a large work after Turner. The "Agamemnon" was etched on a July day in 1870, when Mr. Haden went out and drew (on the copper) this moving picture of a fine old man-of-war, as she lay in the Thames opposite Deptford, being broken up. The towers of Greenwich Hospital are on the left, beyond the hull of the "*Dreadnought.*" Hamerton states that some 2,500 guineas was made from the sales of the first state of this plate. The original etching was lent to us by Messrs. F. Keppel & Co., of New York.

HOUSE OF MISS ALICE KEYS, CINCINNATI, O. MR. F. W. STICKNEY, ARCHITECT, LOWELL, MASS.

COMPETITIVE DESIGN FOR THE CARNEGIE FREE LIBRARY, PITTSBURGH, PA. MR. W. HALSEY WOOD, ARCHITECT, NEWARK, N. J.

ON THE THEORY OF THE ABANDONMENT OF ANCIENT LIGHTS.[1]



DURING the course of the last year there has once more been brought before the Court of Appeals an important case,[2] involving the question of the exact meaning of the legal term "abandonment." The following remarks, which have no pretension of representing a scientific inquiry into the subject, aim merely at working out, if possible, in a simple and practicable form, some definite principle which could be applied to the decision of such cases as that above alluded to.

Now, whenever a prescriptive right to light has been acquired in respect of a certain window, the *position* of which, in the original wall, is subsequently altered (by the aperture being either raised or lowered), or the *plane* of which is altered by an alteration in the site and plane of the wall, the first material question is, of course, "to what 'quantum' of light was the owner of the window — the plaintiff, let us say — originally entitled?"

Now the prescriptive right — according to the natural interpretation of the statute[3] — is a right to all the light which has access to the window in question, *i.e.*, to the "general light of the sky"[4] so far as "intercepted," to use the common expression, by the window. It is usual[5] to speak of this as a "*cone*" of light — by which expression is meant presumably the whole volume of light[6] poured (so to speak) through the aperture of the window from all quarters of the area of sky visible from any part of such aperture. What amount of illumination this "cone" would represent in the case of any given window would clearly depend not only on the nature, height, and extent of the obstacles which obscure, or tend to obscure it, but upon the exact nature of the aperture, the amount and quality of the glass (where glass is employed), etc.

But for practical purposes (legal and not scientific), we need hardly consider the matter in so much detail. Starting only with the necessary assumption that all parts of the sky are equally luminous, we proceed to consider what pencils of light from any part of the whole area of the sky fall, at any angle, upon the plane[7] of the particular aperture. Whether the aperture be well or ill glazed, or not glazed at all, does not affect this question, so long as some appreciable quantity of light passes through it.

The statute says nothing about glass; and though the use of this material necessarily involves a waste[8] of a certain quantity of light which would pass through an unglazed aperture, yet it could hardly be maintained that the volume of light which reaches the plane of the aperture (glazed or open) is not in any case "used and enjoyed" in a legal (and practical) sense, so long as the diminution, from any cause, of the light *without* the aperture would always produce a proportionate diminution of the light *within*.

The extent of the intercepted area of sky seems, therefore, the only material thing to be considered.

For a simple example, let us take the case of a square horizontal skylight, set in the centre of a square courtyard surrounded by four walls of equal height, facing (let us suppose) north, south, east, and west respectively.

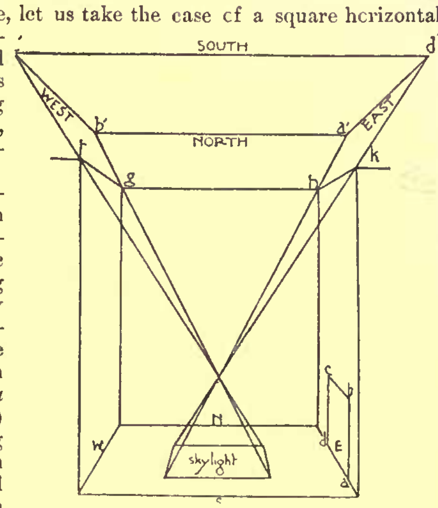


Fig. 1 A.

The base of the inverted pyramid shown in Figure 1 A will accurately represent[9] the required area, being bounded on the north by a straight line, b' a', parallel to and in the same plane with (1) the south side of the aperture a b c d, viz., a b, and (2) the line g h representing the obscuring horizon on the north side; and similarly on the east side by the line a' d', which is parallel to and in the same plane with (1) the line h k (the obscuring horizon on the east side), and (2) the line a d, the west side of the aperture a b c d. And similarly with the other sides, so that if we imagine the base of the pyramid to be a visible superficies, and further imagine one of the four sides surrounding the square courtyard removed in order to give us a view of it, the rectangular area of sky represented by the said base would appear, when viewed in perspective from below, in the form of the figure a', b', c', d', in Figure 1 A. It can easily be seen that the figure would be exactly pyramidal only when the dimensions of the aperture and surrounding walls were as assumed above.

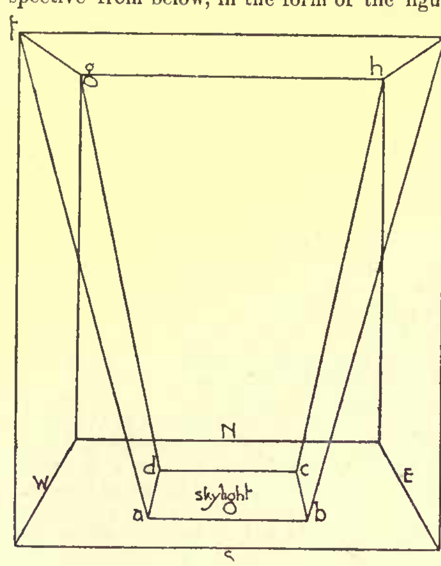


Fig. 1 B.

But if we wish to consider the whole volume of light reaching the aperture a b c d from any part of the aforesaid area of sky, in so far as it is below the level of the obscuring horizons f g, g h, h k, and k f, this will be represented not by any part of the pyramid in Figure 1 A, but by the six-sided figures having for opposite sides the squares a b c d and f g h k, shown (in perspective) in Figure 1 B, and formed by drawing straight lines from the points a b c d to the points f k h g respectively. It will be seen that the apex of the pyramid in Figure 1 A would fall within this figure, also that supposing the straight lines a f, d g, c h, and b k, were produced to any distance, the side f g h k would always fall within the base of the pyramid. Thus the upper side of the figure shown in figure 1 A (were the figures produced to any length) would never represent

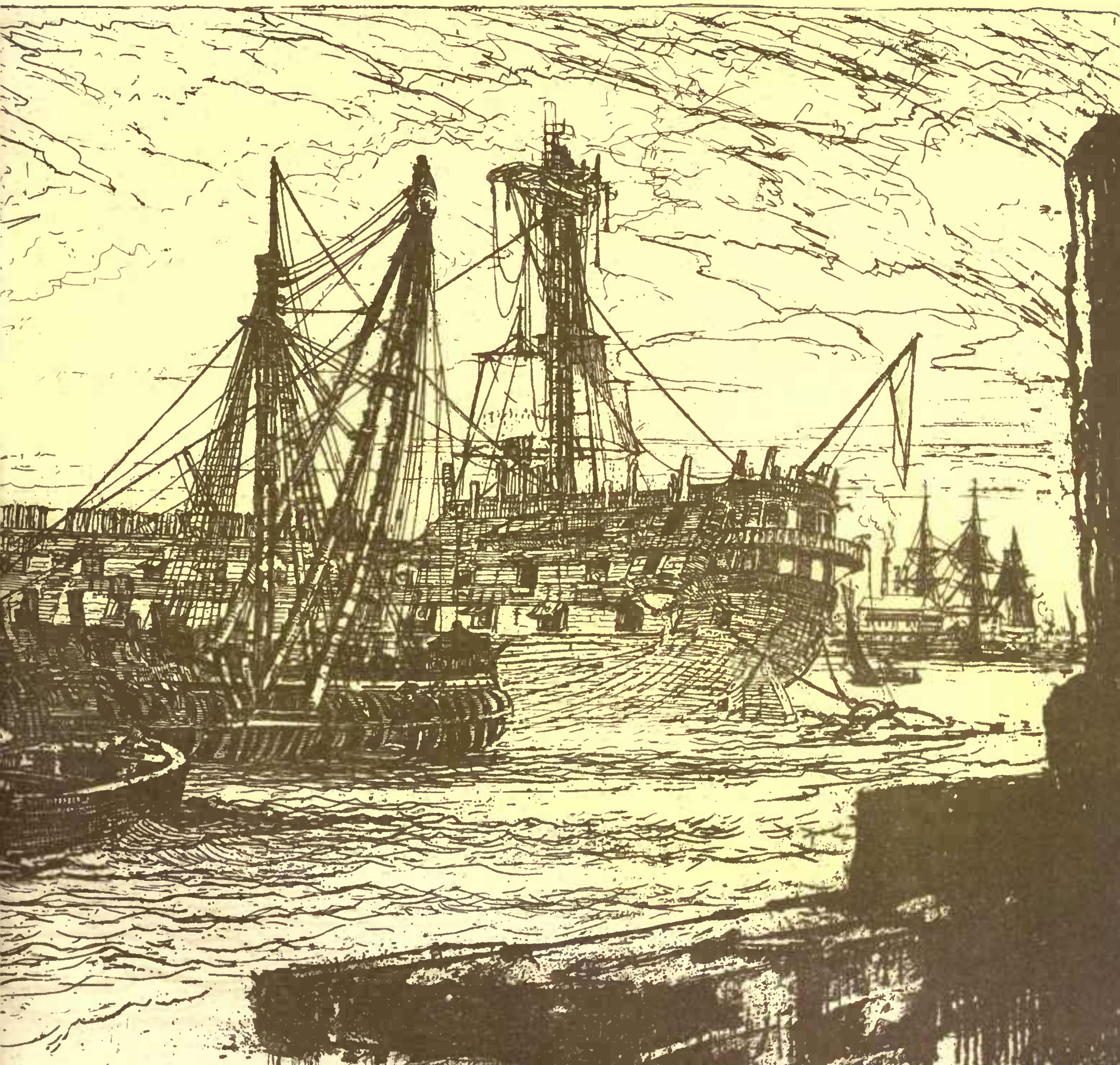
[1] A paper by George H. Powell, Barrister-at-law, published in the *Builder*.
[2] Scott *v.* Pape, reported in 31 Ch. D., 566.
[3] 2 and 3 Wm. IV., c 71 (1882), s. 3.
[4] Homersham Cox on "Ancient Lights."
[5] See judgments and arguments in the case cited above, and in Ancient Light cases, *passim*.
[6] It will be observed that "direct" light alone is here considered, for the following reasons: — (1) That it may (it is submitted) be assumed, with sufficient nicety for practical purposes, that the amount of *reflected* light would vary, *cœteris paribus*, as the amount of direct light: and (2) there seems no ground for supposing that a right could be acquired to "reflected" as distinct from "direct" rays or pencils, or that the mere alteration by the owner of the servient tenement of the reflecting properties of its surface, could form the subject of an action at law.

[7] Which is assumed, in the following argument, to which, however, the point is immaterial, to be the same plane as that of the surface of the wall in which it is set.
[8] For the scientific expression of this, and the trigonometrical measurements of the illumination and obscuration of a glazed window, see the "Optics of Ancient Lights" in Mr. Homersham Cox's work on the subject.
[9] For whatever be supposed to be the surface of the area or arc of sky from which the light is (*ex hyp.*) derived in the first instance, every part of that area must be included in the τέμενος represented at any given altitude by the plane figure a' b' c' d', as viewed from any point within a b c d.



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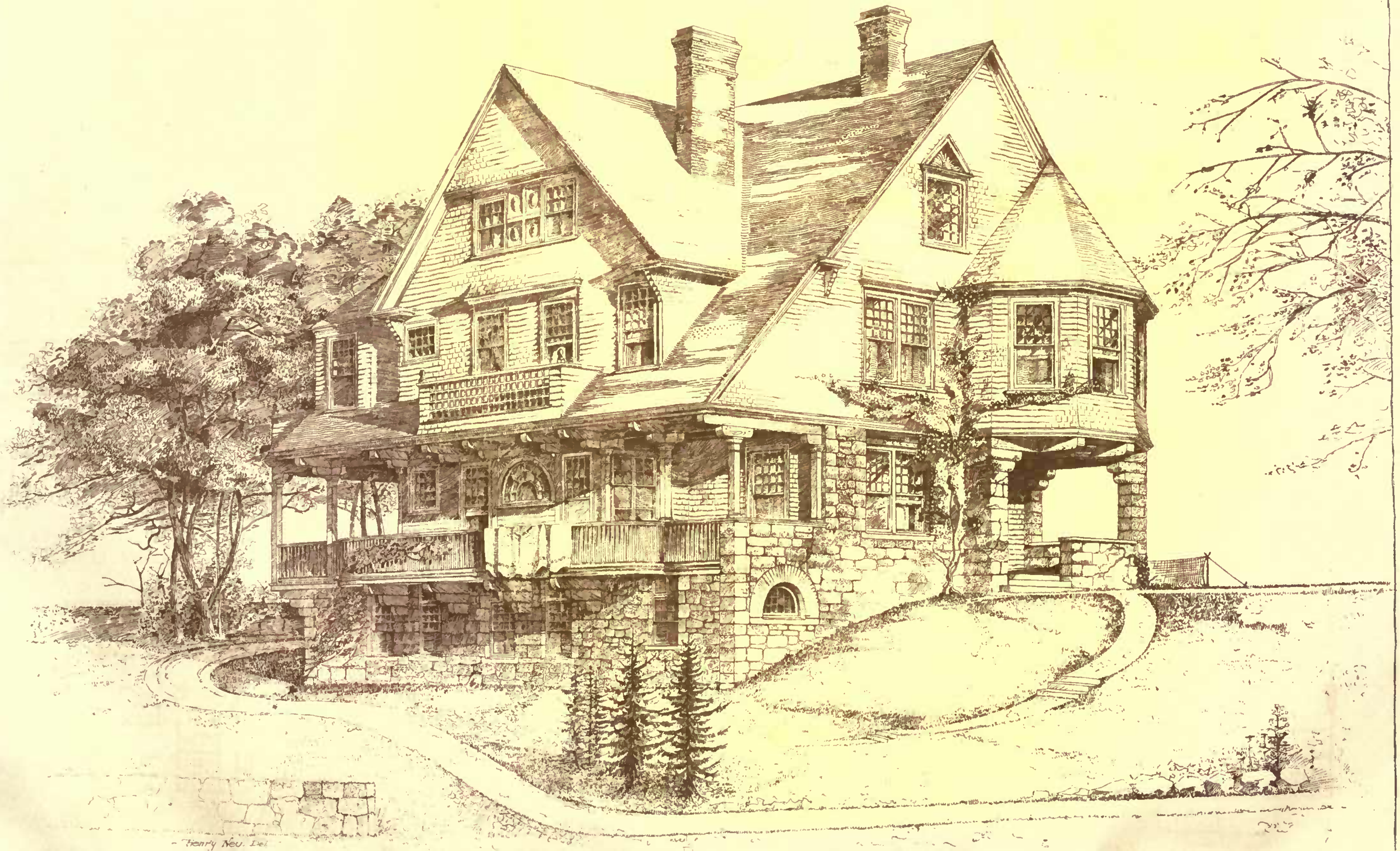


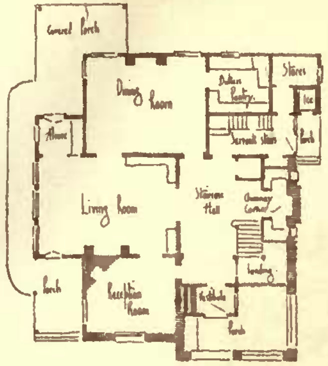
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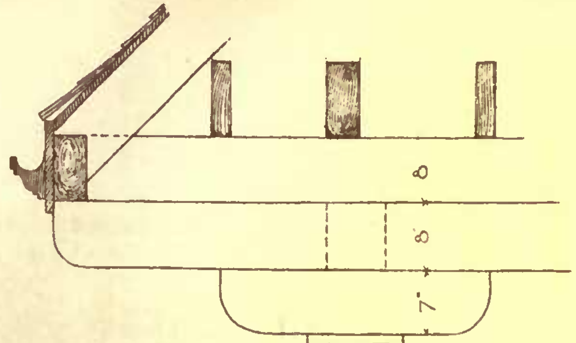
House at Cincinnati, Ohio, for Miss. Alice Keys.

F. W. Stickney. Arch't. Lowell, Mass.

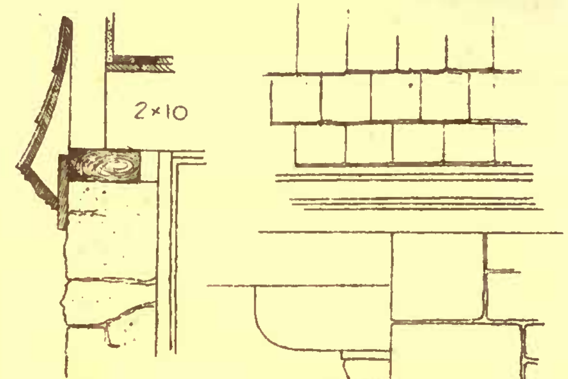




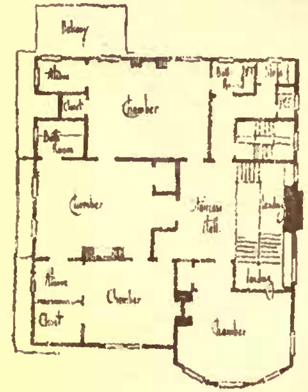
FIRST STORY



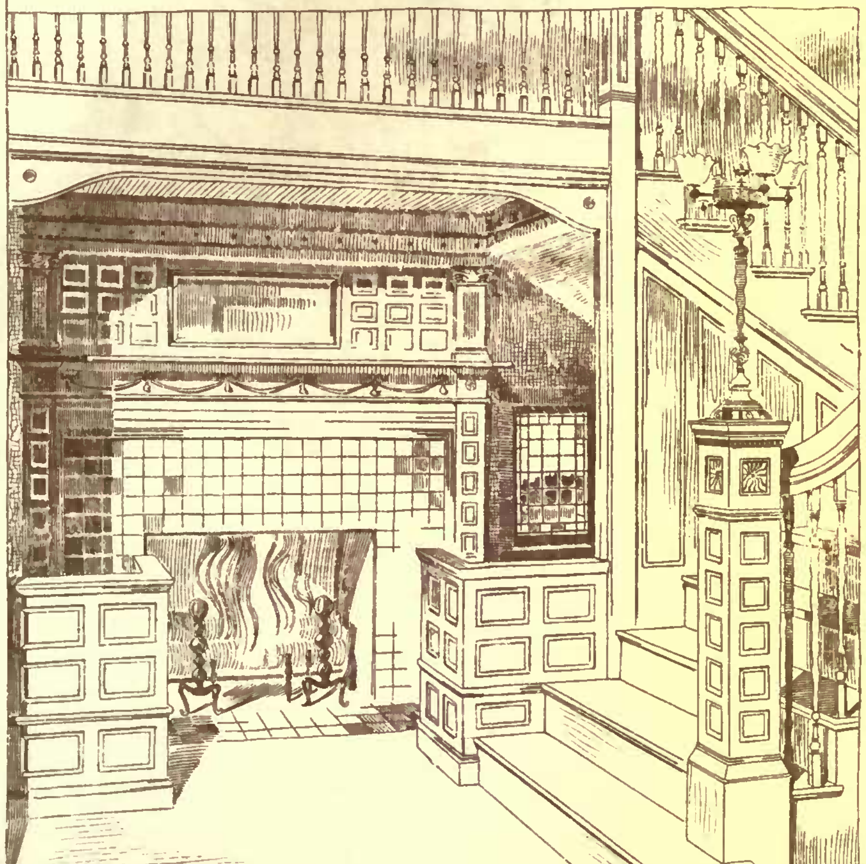
DETAIL OF PIAZZA 1ST STORY



SECTION AT 2ND STORY: FLOOR



SECOND STORY



CHIMNEY CORNER IN HALL



WEST ELEVATION

the area of sky intercepted by the aperture *a b c d*. But, as has been said, Figure 1 A shows this area of sky, represented by the base (*a′ b′ c′ d′*) of the pyramid; whereas Figure 1 B shows the "channel"[1] so to speak, through which all direct light must travel, below the level of the obscuring horizon, to reach the aperture *a b c d*. It is important to observe this, merely because the sides of this figure *a f g d*, *d g h c*, *c h k b*, and *b k f a*, represent the planes beyond which the buildings on the west, northeast, and south sides of the aperture respectively cannot be advanced without obstructing the passage of the light at present intercepted by it.

The base of the pyramid (Fig. 1 A) representing, as has been said, the area of sky from some part or the other of which all the light that reaches the aperture *a b c d* must come, the directions of the various pencils of light must clearly cross one another at various points within the figure representing the volume of light below the level of the obscuring horizon shown in Figure 1 B. The apex of the inverted pyramid (Fig. 1 A), a point some distance above the surface *a b c d*, will be the point where the pencils of light from the extremities (north, south, east, and west) of the intercepted area of the sky *a′ b′ c′ d′* intersect one another.

It will be seen, moreover, that the pencils of light from the extreme northeast, northwest, southeast and southwest points respectively of the area *a′ b′ c′ d′* will be intercepted at the extreme southwest, southeast, northwest, and northeast points of the aperture *a b c d* respectively, and may be represented, as in Figure 1 A, by the lines *a′ a*, *b′ b*, *d′ d*, and *c′ c* respectively. The case of a horizontal skylight in the position above described is only here referred to because it affords, perhaps, the simplest illustration of the principles involved. Moreover, it can be easily seen from this illustration (as represented in the sketch) what would be the effect of moving the position of the aperture *a b c d* (for example) in a direction due east. It is clear that the area of sky would be extended on the west and proportionally diminished on the east side, while its breadth from north to south would remain unaltered. Suppose the aperture to be moved in the east direction till its side *c b* falls on the base of the wall *h k*; then suppose its movement continued upwards in a plane at right angles to the horizontal (in which it was originally), and for the skylight we now have a window,[2] of the same size and shape in the wall on the east side. What is the effect of this change of plane upon the sky-area intercepted? In the first place, that area has been reduced on the east side, since the side *a d* (now the lower side of the window *a b d c*) has moved a considerable distance eastward, and, therefore, the line *a′ d′* (which, as explained above, must always be in the same plane with and parallel to the lines *h k* and *a d*) must have moved westward, and would now (*a d*, as has been said, being in the plane of the wall) be in the plane of the wall produced. In the second place, the sky area will have been extended in a westward direction, since, in proportion as the line *c b* advances in one direction the line *c′ b′* will have advanced in the other. Meanwhile the breadth of the sky-area from north to south will have been enlarged. In the simple case first considered the intercepted "sky-area" would be represented by the base of an inverted pyramid. In the case of a window the intercepted area would be represented by the base of an irregular figure to some extent resembling a pyramid and having as many triangular sides as there were different planes in the obscuring horizons. But the extent of the said area in any given direction could clearly be estimated on the principles applied above.

For instance, let *a b* in Figure 2 represent a window in a vertical plane placed in a wall facing south (viewed in section), and *g* the obscuring horizon on the south side. The sectional area of sky intercepted from *a b* will clearly be bounded on the north side at the point *c* in the plane of the wall produced, and on the south side at the point *d* in the line *a g d*; and consequently the line *c d* may be taken to represent the sectional area intercepted from north to south, by the window *a b*. Supposing there were other obscuring horizons on the east and west, southeast and southwest, or any other quarter, to be considered, figures could be drawn similar to the above (Fig. 2), showing the sectional area that would be intercepted in a plane at right angles, or in a plane at any angle (according to the position of the obscuring horizon) to the plane of *c d*.

Having reminded the reader of the above principles, we pass on (still considering, for the sake of simplicity, the sectional area intercepted by the window in one plane only) to inquire what the law provides in the case when either the position of the window in the wall, or the plane of the wall itself, is altered. To what extent are the supposed plaintiff's rights affected or impaired (for, of course, they cannot be increased) by such alterations? Let us suppose the plaintiff has acquired a prescriptive right to the access of light to the window *a b* (Fig. 3), the obscuring horizon of the servient tenement being represented by the point *g*. Then let the plaintiff's wall be advanced from the position X to the position Y. Now, in considering exactly what is meant by "abandonment," we may begin by observing that the mere advance of the plaintiff's wall from the plane X to the plane Y will, of necessity, deprive him of the enjoyment of a considerable quantity of light which he before enjoyed, viz., of all the direct light coming from the sectional area of sky, *h l*. But inasmuch as this deprivation is entirely due to the plaintiff's own act (and could not in the nature of things affect the rights of the defendant, the owner of the servient tenement), we may dismiss it from consideration. The only "abandonment" which it is necessary to discuss may be defined as the relinquishing by the plaintiff of some right which restricted the defendant in the enjoyment of his property. In fact, if we say that whatever acquired right the plaintiff intentionally ceases to enjoy, constitutes a corresponding restoration of or addition to the rights of the defendant, this statement will only require to be modified by the legal maxim, "*De minimis non curat lex.*"



From *La Semaine des Constructeurs.*

Now, for the legal answer to the question propounded above, we need refer no further back than to the afore-mentioned case of Scott *v.* Pape,[3] in which the most important decisions on the subject are reviewed. The legal right is there stated to be retained in respect of a new window, "*which includes in its area a substantial part of that of the original window, i. e.*, which if the new wall were laid upon the old wall so that their bases coincided, would *substantially coincide with the old window.* Dozens of judicial expositions of this principle

[1] When regarded as a *solid figure*, it represents the volume (see above), the whole volume of light reaching the aperture.
[2] Represented by the part shaded dark in the Figure 1 A.

[3] See Ap., 560; also the recent decision of Newson *v.* Pender, reported 27 Ch. Div., 43; or see recent text-books *passim*, — Shirley's "Leading Cases in Com. Law," p. 238 (1883 edition).

might be cited, were it not well known to be supported by all authority. So long as there is a preservation of a material part of the old aperture so long there is no abandonment of the right, and if there is no preservation of any material part of the old aperture, the right is understood to be abandoned, and therefore lost. This is a perfectly plain and simple principle, and in accordance with it the plaintiff in the aforesaid case of Scott *v.* Pape [1] (decided in February, 1886) did not venture to ask for relief (in the form of an injunction) with respect to those of his new windows (his building having been advanced towards the servient tenement) which could *not* be proved to "correspond" with ancient lights in the original building.

But the various declarations of the law on the subject seem to suggest, in conjunction with the above, another and a different theory, which has only been imperfectly developed. We find it authoritatively stated [2] that if the plaintiff continues to use, through his new apertures, "the same, or substantially the same cone of light" which he enjoyed before, then there is no legal abandonment.[3]

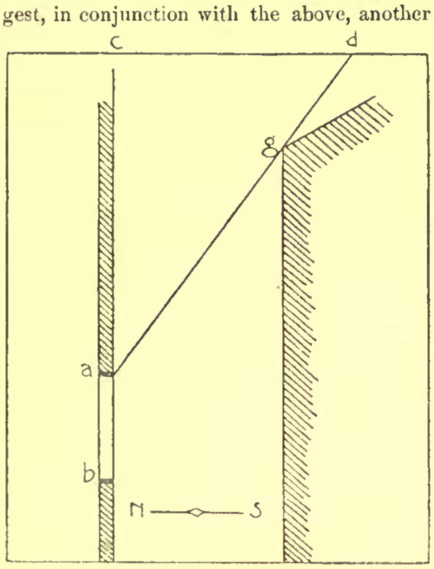


Fig. 2.

In another place [4] the prescription stated is defined as the right "to have arrive for the use of your house" the pencils of light "which, during the twenty years passed through the original aperture," to have "the space within [5] lighted in the same manner" in which it was lighted through the old windows. At the same time, "structural identity" is not, we are told, "the test." The measure of the enjoyment is not the aperture itself, but "the size and dimensions of an aperture in that position" (*scil.* that of the original window). To apply these principles of law to the case supposed (see Fig. 3), the sectional area of the sky, intercepted by the original window *a b*, will be represented by the line *k-a'*. It is clear that there will be pencils of light from the extremity *a'* of this area passing along the line *a a'* through the aperture *a b* to *o*, some object within.

Now, if in the new wall a window, *e f* (in exactly the same position, relatively, as *a b*), be substituted for the original window, there will be, according to the first principal stated above, no abandonment at all; for the window, *e f*, not only substantially, but exactly coincides with the original window, *a b*. But it is clear that no pencils of light from the point *a'*, or, indeed, from any point of the sky-area between *e'* and *a'* can possibly "arrive" at *e f*, and that the "space within" is therefore not (in any ordinary sense of the words) lighted "in the same manner" as before. In fact, no direct light arriving from any point of the sky-area between the points *e' a'* can possibly reach any window placed below the point *e*. But if the access of light which was enjoyed before is now no longer enjoyed, surely it has been in fact and in law abandoned? Conversely, it is obvious that if the plaintiff, having acquired the supposed rights in respect of the window *a b*, wishes to continue in the enjoyment of these rights in so far as is compatible with the alteration in the plane of his wall, far from placing his new window in the position (*e f*) of

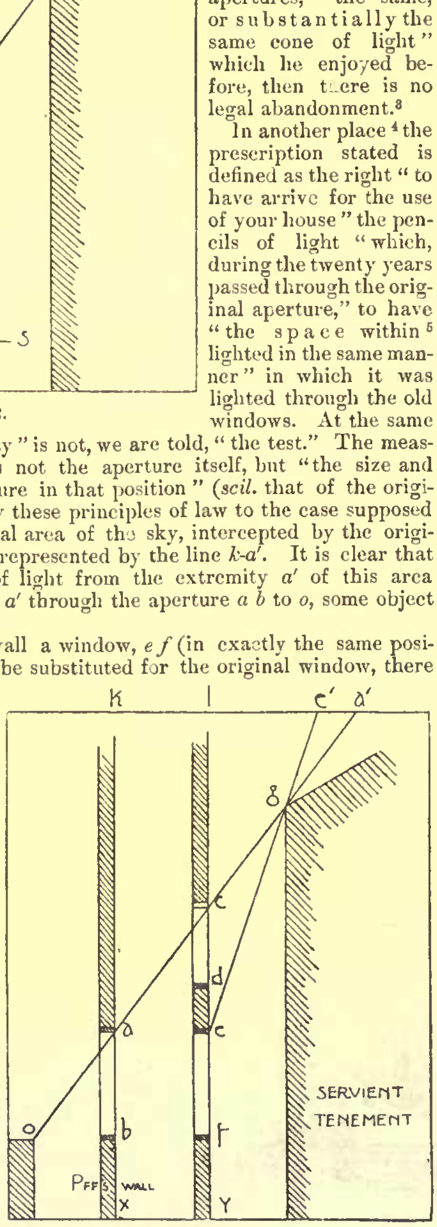


Fig. 3.

[1] See p. 556 of the Report in 31 Ch. Div.

[2] *E. g.*, per Cotton, L.J., 31 Ch. Div., p. 570; and see the cases cited.

[3] Of the meaning of this language we have spoken above. It has been already submitted that the material points to consider are not so much the form in which the light is thrown into the building, lessened or not by refraction, but (1) the "volume" of light (below the level of the obscuring horizon) which illuminates the plane of the aperture (glazed or otherwise); and (2) the area of sky from which the pencils of light constituting that volume are derived.

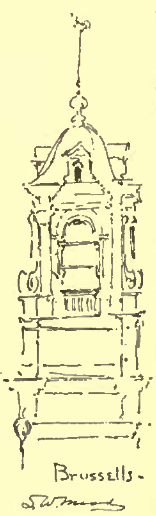
[4] See remarks of Bowen, L.J., 31 Ch. Div., pp. 572-4.

[5] *Ib.*, per North, J., whose decision was affirmed by the Superior Court.

the old one, he must raise it to the position *c d* (the point *d* being supposed to be in a straight line with the points *g* and *b*). If he puts his new window in any position lower than this, he will, in fact (if not in law), be ceasing, to a greater or less extent, to enjoy the access of light, to the enjoyment of which he has acquired a right. Is it possible, then, to follow such clear enunciations of the law as are quoted above with regard to "pencils of light," "cones of light," etc. (the only sensible interpretation of which points to the above conclusion), and, at the same time, carry to its logical results the principle which seems to attach such a magical importance to identity of position — in fact, to a fictitious "correspondence" between the old and new windows? Suppose, for example (in Fig. 3), the window *c d* were the original window, intercepting the area of sky, *l a'*, and the plane of the wall were moved from X to Y (*i. e.*, retired from the servient tenement). If for the original window *c d* a new window, *a b*, were substituted, then, according to all authority, the rights acquired in respect of *c d* would be "abandoned," notwithstanding that, as a matter of fact, the same pencils (to a considerable extent) pass through *c d* as passed through *a b*, and this could not be the case with a window in the position *e f*. Why then is the latter said to be lighted "in the same manner" as *a b*? Again, supposing *e f* to be the "original" window intercepting the area of sky *l e'*, and the wall (Y) to be pulled down and rebuilt in the same plane, the only alteration in the building being a substitution of a window *c d* for the original window *e f*, according to the principles of law at present applied, the plaintiff has "abandoned" the right he had (*ex hypothesi*) acquired in respect of the window *e f*. Yet all the area of sky intercepted by the aperture *e f*, and a good deal more,[6] is still intercepted by the aperture *c d*.

[To be continued.]

SOME FOREIGN PICTURES IN LONDON.



THE French Société des Aquarellistes has done us a good turn in sending some of its members' works over to our grimy city. *Je vous salue, messieurs et mesdames, et je vous remercie!* At last I can say to my compatriots, "There, go and *see for yourselves* what French water-colorists can do!" for, in season and out of season, for years past, have I been sounding the merits of French water-colors, and to what effect? In books, in magazines, as prologues to catalogues, and epilogues to conversation, I always see and hear that "England is the home of water-color painting; that out of England it does not exist; and that whatever we are in other branches of art, in this we are unique and stand alone" — or rather, STAND ALONE, for only capitals can explain in print the satisfaction with which the true Briton enunciates this dogma. But is it so? There are societies enough here, and exhibitions enough, and painters enough — or too many; but is there a member of either the Royal Society, or the Royal Institute, or the un-Royal Dudley, who can wash in a little bit of landscape better, or as well, as the scrap of Venice on one of M. Escalier's fans? Yes, there is one who could, perhaps, but alas! she is not English, and, if I mistake not, is foreign trained, — Miss Clara Montalba. And there is one man here, too, who could equal the figure-painting of M. Maurice Leloir, viz.: Mr. Alma-Tadema; but he, too, is a foreigner. Water-color as it was practised years ago by Turner and De Winst, pure water-color, rapidly and firmly washed, does not exist. There are stippled water-colors, and sloppy water-colors, and papery water-colors, and woolly water-colors, and body-color water-colors; but for the pure art, well rendered, you must go to France or Italy. We have many imitators; but they are worse than the body-color people, for with opaque color it is possible to correct faults; whereas, dashing in color in the wrong place is a fatal deed. These Frenchmen know how to draw —indeed they are mostly and first painters in oil-color; consequently they know exactly what they want to do, and do it. Perhaps their success is a proof of one of my theories, that a painter in oil can soon work as well in water-color; but an aquarellist cannot work in oil without much practice.

Again I must say, "*Je vous salue, mesdames et messieurs, et je vous fais mes compliments.*"

Your show is excellent, with few exceptions. M. Détaille's soldiers seem to me somewhat harder in execution and blacker than heretofore; but what masterly drawings! Compare them with some military studies in the *Graphic* of late. Then a word of praise for the delicious *washes* of Venice and parts of the south of France, by M. Béthune. How slight they are, how solid and how well drawn! I lately saw some sketches of the Norfolk Broads, in Bond Street, by Mr. Fahey, but unlike these Venice ones of M. Béthune, they are hard and papery; and yet there is no more paint on the Frenchman's work than on the Englishman's, and both are equally transparent.

[6] But this, the enjoyment *pro tem.* of more than he had a prescriptive right to, has (since the decision of Tapling *v.* Jones, reported 11 House of Lords Cases p. 260) no prejudicial effect on his existing rights. Probably it would never have occurred to any but a legal mind to maintain the contrary, which was equivalent to arguing that the owner of a right of way should lose that right if he trespassed in his neighbor's field; but, if possible, more absurd, since the plaintiff's action (in the case of light) could hardly, by any stretch of language, be described as a trespass.

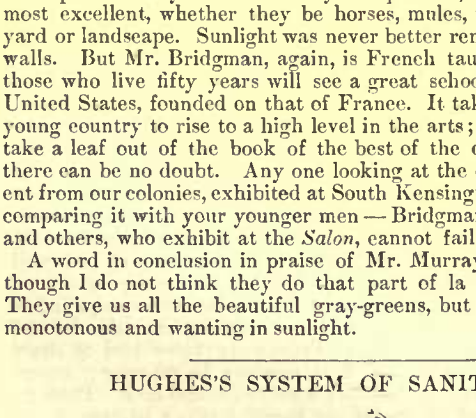
Mme. M. Lemaire's flowers are even better than they used to be, and her quaint little procession of school-girls, in the costume of the first Republic, is most charming.

Another painter of water who is always excellent in his effects of haze, is M. Courant. Some boats with all sail set, on a dead-calm sea at sunset, with that peculiar effect of pink and green sky one sees in hot weather, is one of the gems of the exhibition. M. Cuvillon stipples too much for my taste: I prefer the work of M. Escalier. His *petite femme* in rose-colored garment, playing with a parroquet, is most refined in treatment. And note that so many of these works have no background; are not in effect pictures, beyond the principal subject. This, again, we never see in our galleries. Such work is considered sketchy; but why not exhibit sketches? Besides, a little figure like this and a parroquet is enough for a picture. Why not leave the background vague? If it had surroundings of a wall or of a room, it would not be half so effective. M. Gilbert continues his flower-stall subjects, in rain and in sunshine. M. Duez is not well represented, and I do not care for the art of M. Dubufe, *fils;* there is a false sentimentality about it. M. Leloir is interesting and idyllic as ever; but how one misses his brother Louis! M. Raffaëlli, too, is not here, though some of his school appear: M. Besnard, for instance, has many sketches which are all they should be — charming little bits of interior and landscapes, and odd corners of the Riviera; true *impressions* in the right sense of the term. But his mystic women, vapory as the background, are mere affected follies. Yet even in these, two studies of heads show him to be a fine colorist; then why give way to eccentric affectations? He cannot pretend that there is anything in nature like his "Madeleine!" It is refreshing to turn to M. Adan, whose work is always of the best, even though he still keeps us on the "terrace." I miss another friend, whom I should have preferred to welcome (M. Heilbutte) to M. Vibert, whose comic cardinals, I confess, annoy me somewhat.

Another foreigner, your countryman, Mr. Bridgman, has a large collection of admirable studies on view at the Fine Art Society's gallery. A true Briton's remark I overheard at Goupil's rather amused me, believing, as I do, that fifty years hence you will have quite outstripped us in all arts as well as literature, because *you go to the best schools for instruction*, whereas *we mostly are content with our own ways.* I do not know if you have any term for "true Briton" or "Chauvin," but I presume the feeling must exist to some extent, and so you must have a term for it. But nothing equals the "true Briton"; even the "Chauvinisme" of Victor Hugo barely reached it. Here is the specimen: "Oh, but they only give enormous sums for pictures for the sake of selling them again. The Americans know nothing of art." This from an inhabitant of the *only* city which keeps alive a Doré gallery! I longed to suggest to this good citizen that half the best pictures painted during the last twenty years had gone to America — but then, of course, they are only French pictures! I envy Mr. Bridgman his color, his facility, his draughtsmanship; and, unlike some of his critics, I prefer him to his master, M. Gérôme. Of the finished pictures I will not speak, as they are not equal to many I have seen by this painter; but the sketches are most excellent, whether they be horses, mules, figures, bits of courtyard or landscape. Sunlight was never better rendered, nor cold gray walls. But Mr. Bridgman, again, is French taught. Still, I believe those who live fifty years will see a great school of painting in the United States, founded on that of France. It takes a long while for a young country to rise to a high level in the arts; but that it is wise to take a leaf out of the book of the best of the old countries' school, there can be no doubt. Any one looking at the display of native talent from our colonies, exhibited at South Kensington last summer, and comparing it with your younger men — Bridgman, Thompson, Pierce and others, who exhibit at the *Salon*, cannot fail to endorse this fact.

A word in conclusion in praise of Mr. Murray's Picardy sketches, though I do not think they do that part of la belle France justice. They give us all the beautiful gray-greens, but they are somewhat monotonous and wanting in sunlight. PENGUIN.

HUGHES'S SYSTEM OF SANITATION.



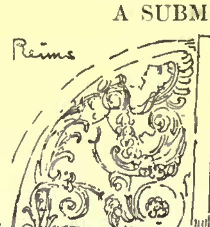
THE system of centre-shaft ventilation, thought out by Mr. W. B. Hughes, architect, of Tunbridge Wells, is chiefly applicable to terraces or buildings erected on the block system, where, to economize space, it obviates the necessity of long, useless corridors, to give access to an outside wall, in accordance with the usual practice. This system is, however, unfortunately opposed to the conditions and by-laws of local authorities, which stipulate that all water-closets shall be built against the outside walls. In Mr. Hughes's opinion, the most perfect system of ventilation is that to be obtained by a shaft or open space extending from the basement to the roof of a house.

In a block of attached houses, all except the two outside can have but two external walls, viz., the front and the back; and, as a rule, the architect, in planning his building, is desirous of utilizing both walls for the convenience of the rooms, which enables him to place the staircase in the centre of the house, lighted by a skylight at the top, which sheds light down the well-hole. The difficulty here comes in of providing the necessary closet accommodation without taking off a long passage from one of these rooms. To obviate this, and simplify the matter, it is proposed to appropriate four feet of the half-pace landing on each floor for closets, lavatories, etc. These several closets on the different floors diminish in length from the bottom upwards, to the extent of about twelve inches on each floor, admitting of a top-light opening into a shaft from the bottom of the building to the top. The bottom of the shaft on the ground-floor is open to the basement, affording a powerful exhaust for the vitiated air and the offensive smells usually generated in the kitchens and domestic apartments. This arrangement also affords easy access to the water and other pipes, at the same time preventing any possibility of their being affected by frost, while they are easily accessible in case of leakage, which frequently causes great damage during severe weather. In the usual arrangement of water-closets, placed against an outside wall, however much the windows may be opened, in fact, probably all the more when they are opened, because they afford admission for the colder outside air, it is noticed that the vitiated and offensive air is drawn into the house, owing to the higher temperature of the air inside, especially when fires are burning. Place them, however, in connection with a central air-shaft with a constantly-ascending current, and all offensive smell will be drawn off clear of the rooms. The naturally-ascending current is intensified by carrying up the shaft the hot-water pipes in connection with the circulation. It is also suggested that the fresh air from the front and back of the house be brought in through the party-wall to each closet, thus affording a direct current of fresh air, which is dispersed without draught through the centre of the house.

Mr. Hughes has ventilated two churches, erected in the suburbs of London, in which fresh air is admitted at each of the aisle windows, entering at the floor-level and dispersing itself through the sills of the windows, thus affording an unbroken upward current, the intensity depending on the fact that, the higher the temperature within the building the greater is the velocity of ingress. A second advantage consists in there being no unsightly provision for ventilation, as is too often the case, while a direct drain is provided for the water of condensation that runs down the windows. Exits for the vitiated air are also provided in the east and west apices of the gables, by means of a six-inch siphon-exhaust, which carries off the heated and vitiated air at the highest part of the roof.

Mr. Hughes is of opinion that an imperfect system of ventilation is the primary cause of defective acoustic properties in buildings, even more so than the arrangement and proportions of the structure itself. Indeed, it often happens that, in an old, ill-ventilated building, the ventilation ingress is confined to two or three points instead of being equally distributed, as it should be. For instance, if the ventilation-inlet be placed at the end of a building opposite the speaker, the sound of his voice must be obstructed and impeded through having to meet the air-current, whereas, if the voice proceeds in the direction of the ventilation, it is carried easily and uninterruptedly to the hearers. This is obvious from the fact that a sound is wafted on the breeze for a long distance, whereas it is exceedingly difficult to make one's self heard when speaking against the wind. J. W. P.

A SUBMERGED MEXICAN VILLAGE.



ONE of the most remarkable of lakes is the Laguna de Tequezquitengo, in the Mexican State of Morelos. It is a beautiful sheet, and has every appearance of being a natural body of water, but, nevertheless, it is artificial and of comparatively recent date. It lies in the depths of a valley about two miles long and a little less in width. A Mexican gentleman who visited the spot — which is remote from the ordinary lines of travel, in the district of Juarez — has written an account of the place, which has been reproduced in the July collection of monthly reports, issued by the Secretary of Public Works, giving statistics and information about agriculture and industries, including the geographical features of the country. The writer (Mr. Eugenio de J. Caños), says: "When, in one of the torrid days of May, the traveller who, for the first time, makes the journey from Puente de Ixtla to Jojutla by the Tequezquitengo Road feels oppressed by the fiery sun, his sight fatigued by the aridity of the hills, among which the highway describes its tortuous curves, and whose dry, dust-covered vegetation inspires only weariness and discouragement; when he vainly seeks to penetrate the veil with which the hazy air limits the horizon on all sides, and longing for a drop of water to moisten his parched and thirsty lips, how grateful, how limpid, poetic, smiling, and fresh is the aspect when suddenly there appears at his feet, in the depths of that topographical depression, the beautiful artificial lake of Tequezquitengo!

"The crystalline aspect of its limited surface is like that of the clearest mirror. Around the lake all is verdure and freshness; beyond, the land is dry, hot, dusty and sad of aspect. The contrast, perhaps, heightens the beauty of the lake.

"What strange creatures are those, seeking, in the water, a refuge from the burning rays of the sun? They are carabaos, beasts of burden, indigenous to the Philippine Islands and imported by the Señores Morro, former owners of the hacienda de San José Vista Hermoso, one of the largest sugar estates in Morelos, within whose limits lies the lake; these carabaos were imported for use on the place. But it appears they were not of the anticipated utility, for they have been abandoned as working animals.

"But there, almost in the midst of the lake, is something which at first glance is seen to be inanimate; it remains motionless, and but for its rigid immobility it might be suspected to be a gigantic aquatic fowl about to spread white and immense wings.

"Descending by the slope of the almost oval basin, in whose depths lies the lake, it is seen that the object penetrates far beneath the surface, that it increases in size, and when one reaches the margin of the liquid element it assumes its correct shape; it is a church! The strange thing which was seen from afar is the cupola of the tower, crowned by a cross. Now may be distinguished perfectly, within the liquid mass, which has a crystalline transparency, the body of the church, its roof, the main portal, the window of the choir, the belfry openings — all as in a phantasmagoric diorama, whose lens is the surface of the serene lake!

"But how is it that it is an artificial lake? our readers will ask. Who made it, and why? How came the church to be there? What is, or what was Tequezquitengo? We will proceed to satisfy, as well as we may, their curiosity, by relating the history of the lake as we heard it from the mouth of some friends living in the neighborhood, as we stood on the margin of Tequezquitengo several years ago.

"Forty years have passed since there nestled in the bottom of the valley the pretty village of Tequezquitengo, where bull-fights and cocking-mains took place on the occasion of the festival annually held in honor of the saint of the place by its natives and their neighbors. Besides the raising of grain and vegetables, the cultivation of fruit and the breeding of cattle, the principal resource of the inhabitants consisted in the collection of tequezquite, as they call an impure sesquicarbonate of soda, produced in abundant efflorence in the lowest part of the little valley, where the rains, alternately collecting and evaporating, formed a little lagoon. On the margin of this, as it dried, the material was found.

"The neighboring hacienda of San José, a beautiful estate, conducts the water for the irrigation of its sugar-cane fields by an aqueduct of six or seven leagues in length. This water is of considerable volume, and it formerly flowed away in the opposite direction to Tequezquitengo, emptying at Puente de Ixtla into the stream formed at that point by the junction of the Tembembe and Chalma. For some reason, now unknown, the administrator of San José changed the course of this stream into the valley, whence, by reason of its slopes of nearly equal height on all sides, the waters found no exit. The little lagoon began to increase in size. It first invaded the grain fields and gardens, then the first houses of the village, then the church; rising and rising until it finally desolated the entire place. The unhappy inhabitants fled from their native pueblo, which now may be seen like an enchanted memory as it rests in the depths of the lake. Two miserable huts standing near the bank were all that remained when we visited the spot. The lake continued to expand and to rise in level year by year, until eight or ten years ago, when it reached its maximum by attaining an equilibrium between the quantity of water entering and that lost by evaporation and infiltration. The shape of the surface is that of an oval, whose length and breadth are something like two miles and one-and-one-quarter to one-and-one-half respectively. The maximum depth is said to measure something like eighty meters, which we believe to be correct, for the level of the lake has been fixed, as upon a gigantic and melancholy hydrometric column, at the last cornice of the tower of the temple, which was built upon the higher part of the plain that to-day forms the bottom, leaving nothing unsubmerged except the cupola." — *Boston Herald.*

BOOKS AND PAPERS.

THE two painters whose lives have recently been published by the Librarie de l'Art, and which form part of the series of "*Les artistes célèbres*,"[1] are as dissimilar as it is possible for two persons to be who express their thoughts through the same medium. Fortuny died famous at thirty-six. Prud'hon lived to be sixty-five, but he had not attained much reputation at the same age that Fortuny had completed his career. The charm of the older painter is beauty of form and composition; that of the younger man, color and light. Prud'hon was a poet; Fortuny the most prosaic of artists. Prud'hon's taste lay in classic subjects: Cupids, Psyches, Zephyrs, or the Muses; Fortuny's was for all that was wild, fantastic and *bizarre.* The art of the one was serious, dreamy or tragic; that of the other highly dramatic. Even in their scheme of color they were opposed — the one always cool and gray, and sometimes verging even on the black; the other, brilliant, sparkling and sunny. This probably was somewhat due to their birth, and fate in life. Both the sons of poor working men, they were alike in losing their parents at an early age, and in being dependent upon friends for their education; but here the similarity ends, for Prud'hon seems to have been pursued by an inexorable fate, while Fortuny became quite early in life, the beloved of the gods.

Pierre Paul Prud'hon (or Prudon, as it was formerly written) was born on the 4th of April, 1758,[2] at Cluny, in the Province of Bourgogne, the house still remaining in a passage in the parish of St. Marcel.[3] His father was a stone-mason, and he was the last of ten children; but he had the misfortune to lose both parents in the space of four months, when he was quite young. His first protector was l'abbé Besson, who made him an *enfant de chœur,* and taught him the first rudiment of education; and so fond was the recollection Prud'hon had of the good curé, that on his return from Rome, he made a portrait bust in wax of his old friend, which is still extant. Through the influence of Besson, the boy was admitted to the school at the Benedictine monastery, and there he received his first lessons in drawing. He made his colors from the juice of flowers and plants; and he fabricated his brushes out of pieces of horse-hair. With these inefficient tools, he copied some of the pictures belonging to the monks. When he was sixteen, the same good priest obtained an introduction for him through Monseigneur Moreau, Bishop of Dijon, to François Devosge, who was also the master of Rude, Petitot, Doyen, etc. Unfortunately, he became entangled soon after in a love affair, which ended in a miserable marriage, and was the cause of most of his subsequent misfortunes. Bad-tempered and disorderly in all her actions, Jeanne Pennet became, not only a charge, but a disgrace, and a perpetual worry to him. Happily, a friendly hand was stretched out to help him through his difficulties, and it was owing to the commissions given him by the Baron de Joursanvault, that he was enabled to live and keep his family.

We glean an insight into Prud'hon's character, from a letter of the Baron's, commending the artist to a friend in Paris, when he left his native place for that city. After speaking of another painter, one Naigeon, M. de Joursanvault goes on to say: "Born of a weaker temperament, easily making friendships, and never doubting those he loves, M. Prud'hon may easily fall over the most frightful precipices. His predominant ambition is to rise out of the crowd of mediocre painters; he works arduously; but he wants some one to make him work."

On his arrival in Paris, he was fortunate enough to find a lodging with some honest working people named Fauconnier, in the Rue de Bac. He became very intimate with the brother, and fell in love with the sister, not having the strength of mind to tell them that he was married; but so great must have been his fascination with women, that although the young girl repelled his attentions, she never reproached him with deceiving her, but remained his faithful friend, and never married.

At this time Prud'hon received a commission from the professor of the Academy of Dijon to paint a ceiling for "*les Etats,*" and it is curious that, like Fortuny in a similar case, it weighed upon his mind all the time he was in Rome. A pleasing trait in Prud'hon's character comes to light during the *concours* for the Prix de Rome. It appears that while working in his *loge,* he heard sighs on the other side of the wall, and breaking part of the partition, he found his rival in despair over his picture. Seizing his friend's brushes, Prud'hon went on with his work, and so good was the result, that it gained the prize; but the young man declaring to whom he owed his success, Prud'hon took his place and went to Rome, with his former fellow-student, Petitot. Prud'hon was never a colorist, and it is to this fact, possibly, that we may attribute his admiration for Leonardo da Vinci. "One who has surpassed Raphael in ideas, in reflection, in sentiment, and in perspective, is the inimitable Leonardo, the father, the prince, and the first of all the painters," he says, in one of his letters. But what seemed to influence him more than anything in Rome was the Faun of the Capitol; and it is to this statue that we owe the type of face always adhered to by Prud'hon. Mme. A. de Tastu (*née* Voïart) points this out in a letter to M. C. Gueullette, and proves thereby that the painter adopted the type before he became acquainted with Mme. C. Mayer, who certainly, judging from a sketch of Prud'hon's, much resembles the Faun. "This style of head," she says, "was painted by Prud'hon long before he knew Mme. Mayer. It came to him from an antique statue, which was the object of his own particular predilection, and which he had much studied — that of the little Faun."

The visit to Rome fortified Prud'hon in his love of form, which, as we have said, is his great charm. Always pagan in his tastes, the antique influenced him far more than Christian art. In his drawings of "La Pais," "La Victoire," and "La Navigation," the treatment of the drapery is quite classic in design.

Prud'hon exhibited for the first time in the *Salon* of 1799, when he was forty-one years of age; the sketch for the picture "La Sagesse et la Verité" gaining for him a studio and rooms in the

[1] "*Les Artistes Célèbres,—Prud'hon,*" par Pierre Gauthier. J. Rouam, Paris, 1886.

[2] Voïart, de Quincy, C. Blanc, and Arsène Houssaye, say 6th April, 1760; Delécluze, 1765; Delacroix, 1759.

[3] A vignette of the house was published in the *Magazin pittoresque* for 1857.

Louvre. Success now came to him. He was commissioned to paint some of the Louvre ceilings and other works; but his domestic miseries seem to have multiplied, and after various difficulties, culminating in a scene with the Empress Marie Louise, his wife was shut up in an asylum.

We now come to the romance of Prud'hon's life, which ended so tragically for Constance Mayer. Neither young nor beautiful, she was admired by the painter, and, living in another part of the Sorbonne, their intercourse was so frequent that she became his pupil. Clever, though too imitative, her pictures show the influence of her different masters, Suvée, Greuze, and Prud'hon; some of them even bearing the mark of the latter's touch, as well as his influence. Of a lively temperament, and possessing a charming expression rather than positive beauty, Mme. Mayer became the friend and mistress of Prud'hon. They worked together, and Prud'hon often took his pupil as model. In 1815 he was admitted to the Institute, and was at the height of his reputation, when a calamity overwhelmed him, from which he never recovered. Mme. Mayer had been suffering some time from a bilious complaint, and was subject to fits of depression. One day she said to Prud'hon: "If you became a widower, my friend, should you marry again?" "Never," replied Prud'hon, reminded at once of all his matrimonial troubles. Thereupon Constance Mayer left the *atelier*, took a razor from the next room, went into her own, and cut her throat. To a nature like Prud'hon's, impulsive, impressionable and melancholy, such a tragedy naturally threw him into despair. He passed the rest of his days with M. de Boisfremont, but never recovered the shock. He went on painting, but his power was gone, and in 1823 he passed away, uttering these words: "*Ne pleurez point, vous pleurez mon bonheur.*" He was buried in Père la Chaise, by the side of his pupil and friend, Constance Mayer.

Of his works, one of his most charming is "Zephyre," a boy of four or five, balancing himself on the branches of a tree, over a running stream. All Prud'hon's children are exquisite: they remind us of Raphael's in their chubby roundness. The Louvre possesses several pictures and drawings by Prud'hon; some, such as "La Justice et la Vengeance divine poursuvant le Crime," grand and noble; others, like "The Assumption," weak and false in sentiment. His taste was essentially a classic paganism, and his attempts at religious art are failures. He also designed various articles of furniture for Napoleon, notably the cradle of the little King of Rome, and a cheval-glass for the Empress Marie Louise. His technique is powerful, but his coloring black. Intending to work in the manner of Velasquez, Van Dyck and Paul Veronese, and reproduce their exquisite pearly gray tones, he omitted yellow from his palette, with the result of producing cold black or brown tints.

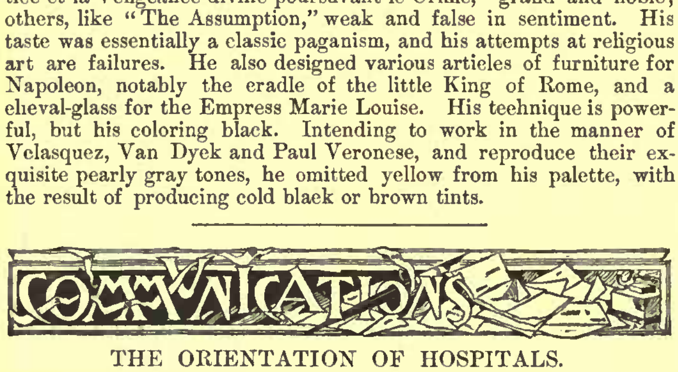
COMMUNICATIONS

THE ORIENTATION OF HOSPITALS.

PHILADELPHIA, PA. April 3, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Many years ago a friend wrote me relative to a hospital he was to superintend the building of, and in which he was greatly interested and a large contributor. He sent me the plans, in which I found the architect had given the sunny exposure to the apothecary's shop, business-rooms, etc., and had put the patients' wards on the north. I sent my friend the details of the Paris hospitals, showing that a much larger percentage of recoveries took place in the sunny wards. In consequence, the whole plan was changed. As hospitals will always be built, it seems to me that you might add to your already great usefulness by calling attention to this matter. I enclose a rough plan of a building, in which every ward gets sun



for fully three-fourths of the day. Perhaps if you offered one of your competitions for the best arrangement of a hospital, good ideas would be elicited. Very truly, M. C. L.

A PLUMBER'S OVERSIGHT.

PHILADELPHIA, PA.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Chancing to pick up your number of January 1, the exploits of plumbers there mentioned leads me to send you the following: Last autumn, as a precaution, I directed a plumber to examine my large tank and see that all was in order for winter. Nothing was wrong, you will understand; it was a precaution, simply. With two men, he labored two days; the next day the ceiling underneath was dripping, and when discovered had soaked a bed, etc. He had put on a new overflow pipe (the tank is fed by a water-wheel), and had not observed that his pipe was choked. L.

NOTES & CLIPPINGS

LIQUID-FUEL EXPERIMENTS. — Last autumn the Russian Government adopted a new type of liquid-fuel furnace, invented by Lieutenant Pashinin, for the torpedo-boat Lerke. Experimental trips before the close of the season demonstrated the success of the new invention, but no details were published as to the results obtained. Since then the same furnace has been fitted to two steamers, built by the firm of Butz and Company, St. Petersburg, for service on the River Oxus. A trial with these took place a few days ago, in the presence of a large number of influential personages, and, according to the *Novoe Vremya*, was again a complete success. The trial demonstrated that 1 pound of petroleum refuse evaporated 15.6 pounds of water, or 2½ times more than coal. During the consumption of the liquid-fuel, a sheet of white paper was held at a height of 14 inches above the funnel, and at the end was neither discolored nor marked with traces of soot. Compared with other systems in use in Russia, the *Novoe Vremya* says that whereas the proportion between the expenditure of coal and oil refuse is 2 to 3, the proportion in the new invention is 1 to 2½. Probably further practice will lead to better results than even these, as at present, owing to the low price of liquid-fuel, Russian engineers have no inducements to be economical. At Baku the price per ton is often as low as 4*d.*, and the question of economy is never thought of at all. On the Volga, however, the case is different, and the farther from Baku the more careful the engineers are found to be. It is expected that Pashinin's furnace will be applied this year to a large number of torpedo boats in the Black Sea, where the supply of liquid-fuel is now plentiful. — *Engineering.*

THE WELSBACH INCANDESCENT GASLIGHT. — We noticed, a few weeks ago, a very beautiful application of the refractory property of zirconium made by Prof. Auer v. Welsbach, of Vienna, in which a cone of net, or similar material, is saturated with a solution of the metal, and exposed to the heat of a Bunsen burner with the result that all the combustible portion of the cone is burnt away, leaving a delicate and incombustible skeleton of zirconium ash, which the heat brings to such an intense state of incandescence that a luminous value of seven or eight candles can be obtained per foot of gas consumed. The idea is very ingenious, and the light is very beautiful, and fragile as the luminous ash is, and liable to destruction at slight provocation, there appears no doubt that the system may be made useful and have a commercial value. But we think that the Welsbach Incandescence Gaslight Company, whose prospectus has been lately before the public, set too high an estimate on the value of the patents, in asking for a part of them, half a million sterling, including, of course, purchase money (£300,000) and working capital. It is true that this sum includes the patent rights in eighteen countries; but Norway, Denmark, Tasmania, Queensland, and so forth, are not large gas consumers, and, in fact, England, France, and Belgium are the only countries in the list on the company's prospectus really valuable. That, however, is a point on which Mr. Punchard and the other promoters have to convince the investing public. But we cannot forget how the whole cause of electric lighting suffered a few years since, from company after company being launched with prodigious capitals, and now that there is a new phase in the practice of artificial illumination, it is to be regretted that the first venture is not of more moderate proportions. For it would be absurd to assume that with the Welsbach system, finality has been reached in this direction. We ourselves are thoroughly acquainted with a system which will be shortly brought before the public as a commercial undertaking, not as a financial venture, which approximates very closely to the results obtained by Professor Auer, but with this important difference, that the light-giving medium is indestructible, instead of being of extreme fragility. And this system will doubtless be followed by others of equal or superior merit and ingenuity. It would have been very interesting, from our particular point of view, if the prospectus of the Weisbach Company had informed us exactly how far the system "has been most successfully installed in Paris," what "extensively adopted" actually means, as regards Vienna, and what favor it has found in Berlin and "other cities," because, without such information, we cannot tell how the cone of zirconium ash stands in general use, what its average life is, and whether the luminous standard is maintained, or whether, after a comparatively short time, it decreases; our own experience has been that it does decrease, but perhaps our experience was unfortunate. The light has been on show at a few places in London, but not long enough to make useful deductions, and the framers of the prospectus would have rendered really a great service had they given precise information on these points It scarcely falls within our province, but we may remark that the abrupt secession of three members of the Board during the days the subscription list was opened, or immediately after it was closed, was almost, if not quite an unprecedented event. Probably a full explanation will be forthcoming of this precipitate retirement on the part of the late directors; we notice that the remnant of the Board has published an explanation, and announced the issue of an amended prospectus, which will be read with interest. Possibly, Lord Beaumont, Mr. White, and Mr. Poston were of the same opinion as ourselves, that the capital asked for is too great, and that a mistake has been made in this way, which may risk the profitable development of a beautiful invention, capable of extensive applications under favorable conditions. — *Engineering.*

Employers' Liabilities.—Messrs. Harland & Wolff, shipbuilders of Belfast, Ireland, write as follows to *Engineering:*

The action of Mr. McGeagh *v.* ourselves, tried last week before Judge Harrison and a special jury at the Antrim Assizes, being, we think, of more than usual interest to the engineering trades and employers generally, it has occurred to us that you might consider it worth while to publish a short *résumé* of the case, the more so that the ordinary newspaper reports hardly bring out the special points on our side as clearly as we imagine they deserve.

The action was brought under the common law, not under the Employers' Liability Act, and was for injuries undoubtedly suffered by the plaintiff through the breaking of a chain which carried a balance weight. The machine was a large self-contained drill, of which the spindle was balanced by a weight of about 9½ cwt., suspended by two three-eighths-inch chains.

The evidence given for the plaintiff went merely to prove the fact of the breakage and its result, while no evidence whatever could be produced of negligence on our part. On our side it was proved that we employed one of the best makers in the Kingdom (Messrs. Smith, Beacock & Tannett, of Leeds) to manufacture the machine, that the chain had a factor-of-safety of 19, and, therefore, greatly in excess of all recognized rules, and that no external examination could have detected a defect in the link that broke.

The case was three times before a jury, and before fifteen judges altogether. On the first trial the jury disagreed, on the second they found a verdict for the plaintiff with £500 damages, but the judge having referred the point of law, on which we relied, to the full bench, the verdict was reversed, whereupon the plaintiff appealed. The Court of Appeal, through some misunderstanding of the evidence, ordered a new trial, giving us the option of taking the case into the House of Lords, and we elected for the new trial, which was the one just decided, as we considered that it would be better to have the misapprehension which some of the judges evidently had, as to the facts, removed by the evidence clearly given in the new trial. The result has been a clear verdict in our favor, and being, as we think, strictly in accordance with the evidence, should form an important and valuable precedent in all future cases, where actions are brought against employers for the consequences of accidents beyond their control.

Had the plaintiff approached us at the outset in any other way than by the medium of a solicitor's letter, there would probably have been no trial, as we felt for his misfortune, although caused by no fault of ours; but in justice to ourselves, and other employers, we could not do otherwise than resist, by all means in our power, the attempt to enforce, by legal proceedings, a claim which we considered neither legally nor morally tenable.

However, as we have now had the case decided in our favor, we have adopted the suggestion of the Court, that the plaintiff should receive a substantial solatium.

A Legend of the Walls of Algiers.—In many cases the recollection that a death occurred when the church or castle was built lingers on, but its cause is forgotten, and a new legend has been invented to account for it. This is probably the origin of the stories of the murder of an apprentice by his master. An apprentice was killed and buried in the wall, not out of jealousy, but out of a notion of giving stability to the wall. Perhaps the Mohammedans have a similar notion, for, when the walls of Algiers were built of blocks of concrete in the sixteenth century, a Christian captive, named Geronimo, was placed in one of the blocks and the ramparts built over and about him. Since the French occupation of Algiers a subsidence in the wall led to an examination of the blocks, and one was found to have given away. It was removed, and the cast of Geronimo was discovered in the block. The body had gone to dust, and the superincumbent weight had crushed in the stone sarcophagus. The block is now, we believe, preserved in the cathedral of Algiers.

In 1514 the spire of the cathedral church of Copenhagen was erected. A carpenter's assistant had an altercation with his master as to which had the steadiest brain. Then the master ran the beam out from the top of the tower, took an axe in his hand, walked out on the beam, and struck the axe into the end of it. "There," said he to his man, on his return, "go out and recover the axe." The assistant instantly obeyed. He walked out; but when he was stooping to take hold of the axe it seemed to him that it was double. Then he asked, "Master, which of them?" The master saw that he had lost his head, and it was all up with the man, so he said, "God be with your soul!" At the same moment the man fell, and was dashed to pieces in the market-place at the foot of the tower. It is possible that this may be the true version of the story; but it is more likely that the man was flung down by his master, with the deliberate purpose to secure by his death the stability of the spire he had erected.—*Cornhill Magazine.*

Screw Systems.—The world of machinery is parcelled out to-day between the screw system devised in this city by Mr. William Sellers and that invented in England by Sir Joseph Whitworth, and the choice of screws the world over is being rapidly narrowed down to these two systems—one straight-edged and the other curved. The April number of the Franklin Institute's *Journal* gives an interesting correspondence, drawn out by a letter from the Society of German Engineers, which is considering the adoption of a screw based on the measurements of the metrical system. The letter is accompanied by the statement of London *Engineering* that the Sellers, or straight-edged screw, is going out of use in this country. The *Journal* prints a number of letters on this subject which show that since its adoption by the United States Navy in 1868, and the Pennsylvania Railroad, this system has come into use on 2,200 miles of railroad, it has been generally adopted by the large private establishments all over the country engaged in constructing the heavier classes of machinery, and the Pratt & Whitney Company report that 90 per cent of their orders require this thread and pitch. To many this struggle between various screw-threads would seem trifling, but it is on advantages like these that commercial supremacy turns and the general adoption of the Sellers or Whitworth system on the continent of Europe to-day would leave its mark for the next half century in determining whether American or English models, inventions and machinery were most employed, and affect national profits on the trade and manufacture of these objects in all parts of the world.—*Philadelphia Press.*

TRADE SURVEYS

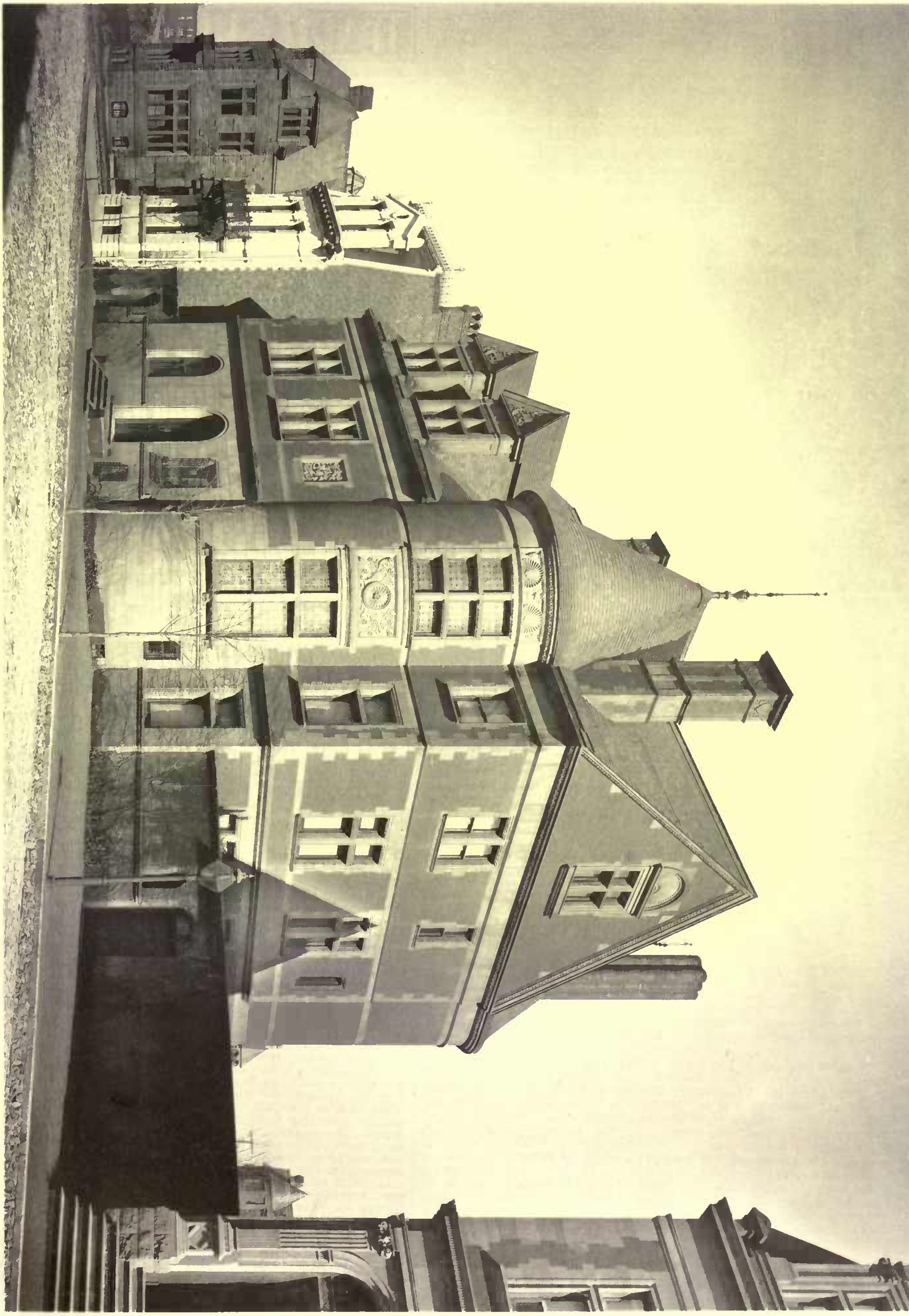
Among the favorable features in the industrial and business world are the steady increase in the volume of currency, amounting, all told, to $60,000,000 in eight months, the steady improvement in the value of real estate, amounting to some hundreds of millions within a year, the expansion of a healthy building activity, estimated at from twenty-five to thirty-three per cent over last year, and the steady organization of railroads, manufacturing, and general business interests. Following these favorable conditions is an increased purchasing-power upon the part of the masses of the people. Among the unfavorable features, or rather possibilities, may be mentioned the lack of a permanent national banking system, the possibility of an over-development of railroad building, manufacturing and house building, the possibility of an undue appreciation of real-estate values, and the possibility of a renewal of labor agitations. Few subjects have been more closely studied by business men in all avenues, than that of guaging production to demand. If the country is to be visited with industrial and financial ups and downs this fact, or even the probability of it, will have considerable weight with the industrial and railroad captains of this age, who are leading in all the great enterprises. There are a variety of questions to be considered by those who control the investment of enormous capital; some of these questions lead into the domain of theory, others are bounded by the limits of experience. The practical men are discounting all these probabilities, and are basing their probable future course upon the one great fact, that the consumptive requirements of the country must, of necessity, steadily increase year by year. There is no doubt but that some sort of an increase in currency, year by year, is favorable to increased activity; at the same time it is true that increased currency, while stimulating healthy activity, also stimulates speculation, and creates speculative values. These speculative values act indirectly in the nature of a taxation on productive labor. We are now making up for the dulness of 1884–5; for a year or two more, at least, we are safe in our present phenomenal activity, what 1889 and 1890 may bring forth is too far off for all excepting those who are concerned in the safe investment of capital for future returns. It has, heretofore, been said that as long as consumptive requirements are not fully provided for there is room for and need of expansion; and increased production, and no excuse for restrictions, depressions, panics, or declining rates of compensation to labor. Our advices from all industrial centres during the past few days indicate a gradual restoration of confidence which existed earlier in the season. The readjustment of railroad rates is steadily going on, and public opinion is recognizing the essential merits of the new legislation. The railroad companies, who were naturally jealous of their absolute control over freight rates, will, no doubt, gradually come to recognize the justness of the law, and the advantages which are to flow from it. Railroad building is still projected in the West and South. All kinds of building operations are increasing, and something akin to a boom is in progress, more particularly in the Western States. Architects are extremely busy, and builders are full of contracts. Reports just published this week from the American Iron and Steel Association show that last year's pig-iron production was forty per cent in excess of that of 1885; Bessemer-steel ingots forty-nine per cent; steel rails sixty-four per cent; crucible-steel ingots twenty-five per cent; rolled iron twenty-six per cent; nails twenty-two per cent. For every twenty tons of crude iron made in 1876, sixty-three tons were made last year. For every five tons of Bessemer ingots, twenty-five tons. For every four tons of steel rails, seventeen tons. For every ten tons of rolled iron, twenty-two tons. For every four kegs of nails, eight kegs.

Old rails have advanced within twelve months at Atlantic ports from $23 to $28. Number 1 Foundry from $18.50 to $21. Steel rails at mill $34.50 to $39.50. Merchant bars $1.90 to $2.20. Imports of iron and steel, including tin plates, last year were 1,230,393 tons against 647,895 tons. At the opening of the year 23 blast-furnaces were in course of erection; since then perhaps as many more have been projected. There are 64 Bessemer converters in operation, and the production of steel ingots for 1886 was 2,541,393 net tons. The total steel output last year averaged 100 pounds per head of population. The production of coal was 106,280,033 tons.

The enormous expansion taking place suggests the possibility of over-production, but as long as the country can pay dividends on two or three thousand million dollars' worth of material stock, trouble of this sort need not be borrowed. The great industries are all prospering, confidence is being restored by a partial return to the former freight rates within State limits. Builders are buying freely.

Agriculturalists are encouraged and implement-manufacturers are full of summer orders. Wood-working machinery-makers, and planing-mill and saw-mill machinery-makers have increased their work this month enough to preserve firm prices on all good work.

Architects are very busy in all cities from which reports are received. Bank, mill, warehouse, factory, church, and school-house building will be more abundant this year. River and lake crafts are called for. Coastwise tonnage is scarce. Cars are needed faster than supplied. This general activity is not of a haphazard character, but is the product of far-seeing enterprise and careful calculation. The development of small industrial enterprises is a favorable feature. Manufacturers are putting money into small houses in the South where there is an absolute scarcity of dwellings, and builders, with the assistance of local capitalists, are, in several cities, such as Memphis, Kansas City, Wichita, Birmingham, and Chattanooga, preparing to supply a demand which promises to pay excellent returns. As remarked months ago, the proper housing of the wage-workers of the world promises to engage the attention of a great deal of capital and enterprise. Commercial failures show that slack management is as dangerous as ever in business. The multiplication of little industries show that men of small capital have more favorable opportunities than in years past. Democratic freights in transportation will encourage small producers in new localities. The decentralization of our industries is progressing steadily, and the effects will be marked. The work which should have been done in 1883–4–5 is now being pushed through, under better surroundings. The rush of foreign laborers will continue until an equalization is established, and until employers will be placed in possession of an additional factor-of-safety from undue dictation. The law-makers are hastening to acquit themselves in the matter of legislation, but the deeper causes at work may, in the future, nullify the anticipated benefits of law, arbitration and combination. The exceptionally active demand for labor leaves employers less latitude to resist or barter for more favorable terms. Their turn will come as it has in times past.



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HELIOTYPE PRINTING CO., BOSTON

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, by TICKNOR & COMPANY, Boston, Mass. No. 593.

MAY 7, 1887.

Entered at the Post-Office at Boston as second-class matter.

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THE past week or two has witnessed some curious manifestations of the rapid process of disintegration which is going on among the great labor organizations. One of the first important defections from the Knights of Labor occurred among the silver-smiths. These are usually intelligent, honest, and highly-paid men, but, in an evil hour, they listened to the exhortations of the paid enthusiasts and joined the "colossal organization." The number of persons in the trade is not large, and the labor autocrats, having got them securely bound, found it easy and convenient to use them for that great object of injuring their employers, in comparison with which, as Mr. Powderly says, "the suffering of the individual workman is of little importance." After the well-known methods of annoyance based on this view had been practised for some time, the masters rebelled, and gave notice that after a certain date all the principal silver-working establishments would be closed until assurance was given that the business conducted in them would be managed by their proprietors, and not by the "colossal organization." They were answered by the customary bragging and bullying, but they kept their word, and, on the appointed day, their doors were closed to all who chose allegiance to the Knights of Labor in preference to faithfulness to the service which they were employed to perform. The largest establishment of the kind in the country is that of the Gorham Manufacturing Company, which maintains eight hundred persons, all or nearly all of whom were members of the Knights of Labor. The managers of the Company, somewhat deceived by the vaporings of the knightly mouth-pieces, prepared themselves for a struggle of several months' duration, but their operatives, after considering for about three days the advantages of being ridden by a colossal organization as compared with those of working independently for the benefit of themselves and their families, voted to give up their knightly charter, and return at once to the places which still remained open to them.

IN another place, about the same time, an attempt was made by the managers of an International Union of Iron-workers to carry out the ordinary tactics of enforcing obedience to their orders by tormenting innocent people. It seems that a certain firm of stove-founders in St. Louis had incurred the malice of the International Union, which resolved to ruin its business. As it happens, the stove-founders of the country have a defensive association, the members of which help those of their fellows who are "struck" by making castings for them, in order to enable them to fill their orders, and in the present case, the patterns of the St. Louis establishment were divided among several firms in New York State belonging to the Association, in order that they might be used for casting. The International Union heard of this, and ordered its subjects to "strike" all foundries in which an attempt should be made to cast from the St. Louis patterns. The order was obeyed, and several hundred men, at a signal, gave up the employment by which they and their families subsisted in order to gratify one of the parties to a squabble a thousand miles away, of the merits of which they knew nothing whatever. As in the case of the silver-smiths, two or three days' reflection was enough to convince the stove-casters that the sacrifice they were making was altogether disproportionate to the occasion, and they voted to defy the orders of the International Union, and to go back to their work without troubling themselves further as to whether the patterns they were using came from St. Louis or elsewhere. Still further indications of the return of common-sense to the members of the "colossal organizations" are to be found in the results which have followed the adoption of the nine-hour day in the building trades. To hear the representations of the labor agitators, it would seem that the whole body of carpenters, plumbers and masons has for many years been sighing in vain for the reduction of the working day to eight hours, in order that they might have time to improve their minds; and that nothing but the heartless tyranny of "capitalists" and "monopolists" has prevented them from securing this precious privilege. In point of fact, however, since the orators have at last prodded their reluctant subjects into making a successful demand for a nine-hours' day, the latter seem to have taken to spending their leisure moments in revolving schemes for evading the new rules, and working ten hours instead of nine. In one case, within a week or so after the compromise which has become general, of nine hours' work and pay by the hour, had been adopted, the workmen employed by a large contractor went to him, and asked the privilege of working ten hours a day for the first five days in the week and five hours Saturday. This would make fifty-five hours' work in a week, instead of the fifty-four hours agreed upon in the compromise, but, as the men said, it would be so much more convenient for them to make full days the rest of the week and have Saturday afternoons to themselves for cultivating their gardens or amusing themselves and their families, that they would willingly give the extra hour's work for the sake of making the modified arrangement. We suppose that the labor quacks who heard of this must have wept at the backsliding of their unruly disciples, but the contractor, who had himself worked hard all his life, and knew the value of a half-holiday, thought the idea a very sensible one, and willingly agreed to pay the extra price for the extra hour in the week's work, although, according to the quacks, who maintain, when they wish to gain a point, that men do more work in a nine-hours' day than they do in one of ten, he would, by the modified arrangement, suffer a loss of five hours' work a week, instead of a gain of one, and ought to have docked his men of ten per cent of their wages, instead of giving them more. Unless this view of the case should occur to the contractor, it is easy to see that other men will ask the same privilege, and the result of the modification in the agreement will be that in the autumn, when the crops have been gathered from the little garden, and it is too chilly for picnics with the children, the men will, very gently, for fear the orators may hear them, begin to propose that the Saturday half-holiday should be discontinued, and that on that day a full days' work should be accepted and paid for. We venture to say that unless some meddler interferes, none of the men will suggest a return to nine hours for the other days of the week in place of ten, and that matters will quietly fall back to the condition in which they have usually been during the winter, except that the contractors will have gained the point against which the agitators have fought so hard, of paying by the hour instead of by the day. Whether the labor autocrats will look on quietly at this dodging of their decrees remains to be seen. To them, disregard and neglect are fatal, and as they know perfectly well that their salaries and their influence depend upon making themselves conspicuous, it is very likely that the autumn may see some desperate movement concocted to upset the industrial world, and bring into renewed prominence the figures of the self-styled champions of labor.

THE rôle of critic is not a pleasant one, yet we are frequently disposed to regret that a mixture of motives prevents us from assuming it at times and applying what of caustic criticism there lies in our pen to saying many things which we feel ought to be said concerning some American architectural designs. The undesirableness of giving personal offense, except in cases of real necessity, is probably the chief feeling that prevents editors of architectural journals everywhere from saying

anything in disparagement of the designs they accept for publication, and yet they must feel, as we do, that a little wholesome criticism of a design laid before the reader's eyes would be, after people got used to it, the most useful and welcome thing an architectural journal could undertake for the benefit of its readers and the art at large. Custom or good sense makes such a course impossible, and the editor's aspirations to act the critic's part is almost wholly restricted to the rather unsatisfactory task of politely declining offerings which he would gladly accept for publication if he might only be allowed to say his say concerning them. This, of course, applies mainly to private work and unofficial designers. With public work and functionaries supported from the public purse the case is different, and editors should feel at liberty to save the public's credit and money whenever possible, no matter whose private feelings may be distressed. It is our duty, as it is our pleasure — usually — to lay before our readers the designs for Government buildings, prepared in the office of the Supervising Architect of the Treasury Department. This duty we cannot discharge to-day without entering our emphatic protest against, not the execution of the preposterous design that has been prepared for the Detroit post-office, for it is not supposable that such an abomination could really be built, but against such an inexcusable misemployment of time (we can't say talent), which is paid for from taxes in the proper dispensing of which we all have an interest. That any one could be found in the Supervising Architect's office who, in his waking hours, could put together such a creation as this would be bad enough, but that such a person should chance to have over him a superior officer so indiscreet as to put forward this thing of incongruous parts, no scale and less style, as the design for a building belonging to the United States is absolutely discouraging. It seems to us that after such an exhibition as this even the most obtuse legislator must see that the present method of obtaining designs for public buildings is a matter which calls for prompt action and total reconstruction. It is not necessary to suppose that the Supervising Architect himself made this design in order to hold him responsible for its eccentricities. The actual designer may have fairly valid excuses for what he did: he may have been trying to evolve *the* "American style"; he may not have known how far off the track he was straying; he may, even, have been playing a huge practical joke on his superior, fully believing that his comical conceit would be found out and his fun stopped before things went too far. But it is not easy to see how even the most easy-going person, in whom a few years of official life can hardly have nullified former architectural instincts, can hold himself blameless in such a matter. The worst of the matter is that there seems to be another designer in the office who is capable of turning out really creditable work, as, for instance, the design for the Galveston court-house, published a few weeks ago, and it seems strange that an official who passed the Detroit design should not have rejected the Galveston design, on the plea that if the first was good and proper the second must be bad and unallowable.

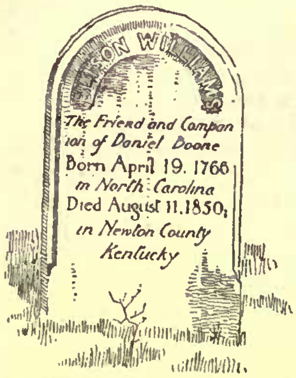
A LETTER printed in another column reminds us of a discussion which took place not long ago in the Royal Institute of British Architects, as to the duty of architects toward contractors. The discussion was introduced by Professor Kerr, who read a paper in which he conveyed the idea that architects ought to be guided by something better than technical literalness in interpreting so complex a matter as a building contract. Most of us, probably, have had the same idea, and have felt that the architect, who can judge better than either party to a building contract, as to the true meaning of its stipulations, or the value of the work to be done in accordance with them, ought to exercise a sort of abstract justice in deciding points under the agreement, so that the owner should come out of the affair with just what he ought to have, and the contractor with his fair dues and no more. Within certain limits this is perhaps a good principle, and the architect should certainly avoid anything like collusion with either party, to mislead or wrong the other, but he should be careful not to go too far in awarding what he thinks to be justice to one, at the expense of the other. To take a very common case, where the builder makes a mistake in his figures, and signs a contract for a sum insufficient to cover the cost of the work, the architect is not at liberty to do anything whatever to make good his loss at his client's expense. If he discovers the mistake in the estimate before the contract is made, he may, and would, we think, be legally bound to advise his client of it, and the latter could not then take advantage of a contract based upon an error of which he was aware; but if the agreement has been entered into in good faith by the owner, the architect cannot give away his client's money, to use the words employed by one of the participants in the discussion which followed the reading of the paper, even to make up a real loss on the part of the contractor. He may go to his client and put the case before him, leaving it to his generosity to make the contractor's loss good if he wishes, and in most cases the client is very willing to do so; but if he should not be willing, the architect can do nothing further. In many instances this seems rather hard, particularly where the contractor is a poor man, not much skilled in technical expressions; but it should not be forgotten that he takes the risk of his own mistakes, and, as he would hardly be likely of his own accord to hand back to the owner any part of his balance of profit in case the work proved much easier or less expensive than he thought it would, he cannot expect the owner to make good his loss if the error in calculation happens to be the other way.

IT would be interesting to know whether any of our readers remember anything about the Marquis de Foulon, who died in London a few weeks ago at the age of ninety-two. Few architects have had so romantic a history as this courtly old gentleman. He was born into the highest rank of the French nobility just as this haughty caste was overwhelmed by the revolt of the infuriated sans-culottes. The preceding Marquis, whether the father or the uncle of the architect, the *Builder* is not certain, is somewhat celebrated in history for the tragical fate which he suffered at the hands of the mob. A current report, the truth of which the younger Marquis always denied, accused the other of having laughed at the sufferings of the populace in the days just preceding the Revolution, and of having told some of them to "go and eat hay." Scores of similar tales were maliciously circulated about the aristocrats, and it is not very likely that this one had any foundation, but it was eagerly swallowed by the rabble, and one day, as the Marquis was driving with his wife through the streets of Paris, his carriage was set upon by a mob, and he was dragged out and murdered. The assassins then stuffed his mouth full of hay, and hung his body to a lamp-post. The family of the murdered noble, like most others of their own rank, fled from France, and the heir of the title, as soon as he was old enough, was obliged to earn his living. He became a pupil of Nash, the most fashionable architect of the day, and gained, by his high rank, admission to his master's house, where he often met the Prince Regent and the other leaders of that society which Thackeray describes. Soon afterwards he came to America, and, as the *Builder* says, "built more than one theatre in New York," but he found business dull, and the society of the Americans uncongenial, and returned to England, where he practised his profession for many years, a part of the time as a draughtsman in one of the public offices. Very few of our architects are old enough to remember much about the practitioners of fifty years ago, but there may be some one who can add something to this story of the achievements of a very grand seigneur with the T-square and drawing-board in place of his ancestral shield and sword.

EVERY few months some paragraph circulates through the newspapers in regard to the wonderful effect of the electric light upon plants. Not long ago it was observed that lilies which had closed at sunset opened again when an arc lamp in the neighborhood was lighted, and it has often been remarked that flowers keep much fresher in the evening in rooms lighted by electricity than in those with gas or candlelight. Beyond this, however, the effect of electric light appears to be rather injurious than beneficial to plants. Some years ago a rich amateur tried the experiment of illuminating a greenhouse with arc-lights. For a short time the plants appeared to flourish, and grew rapidly; but the growth was soft and unhealthy, no flowers appeared on the shoots, and the plants soon fell into atrophy and decay. Whether incandescent lights would produce the same effect or not, has, we believe, never been tried; but it is generally believed by florists that plants, like animals, need seasons of darkness and sleep, and that any light in a greenhouse at night is prejudicial to the health of its occupants.

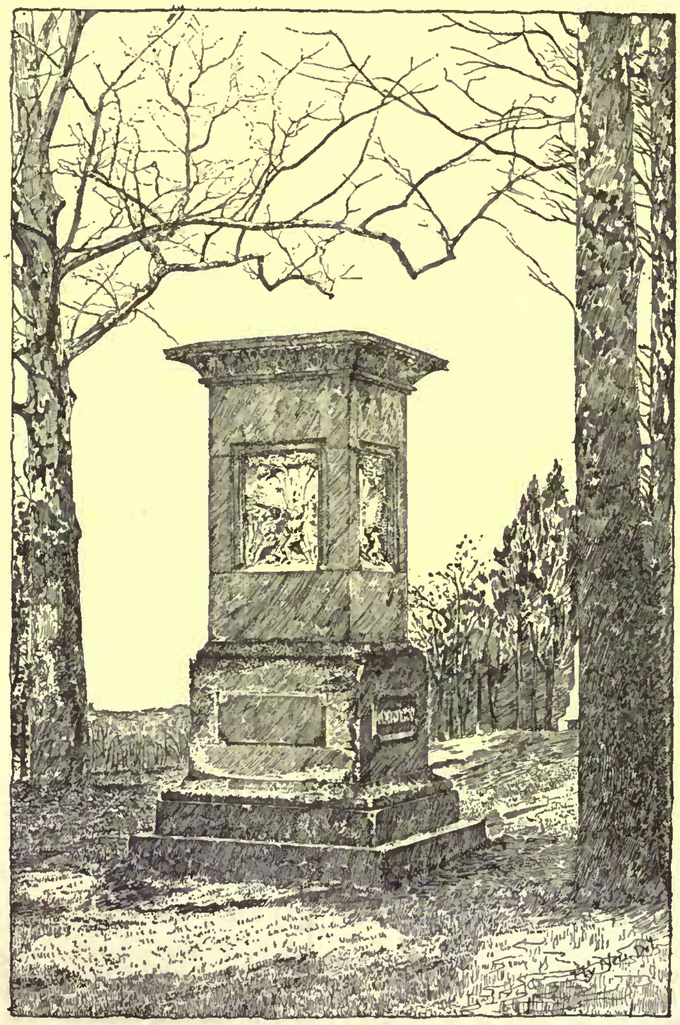
EARLY SETTLER MEMORIALS.[1]—IX.

DANIEL BOONE.



DANIEL BOONE has always been regarded as the most distinguished pioneer of Kentucky, from the fact that he was the first white man who made a permanent settlement in the State, and underwent more fatigue, trials and hardships than any other man who ever visited the State at that early period. He was born in Bucks County, Pa., on the 11th of February, 1731. In 1769 he first visited Kentucky, and in 1775 founded the town of Boonesborough. In the same year his wife and daughters arrived from their home in North Carolina, the first white women, so far as known, who ever stood on Kentucky soil. Boone had been absent from his family three years, and during that time had never tasted bread or salt, nor beheld the face of a single white man, excepting his brother, and the friends who had been killed by the Indians. The vicissitudes which this great American pioneer passed through from 1771 to 1795, when he went to Missouri, are a history in themselves, and justly regarded by historians as greater than any romance, and as fully typical of the wondrous period of early pioneer life in America. Becoming greatly dissatisfied with the ill-fortune that attended him in Kentucky, he went to Missouri, and devoted the remainder of his life to the chase; even after his energies became enfeebled through age, he would wander to the remotest wilderness he could reach. As late as 1816 he made such an excursion to Fort Osage, a hundred miles from his residence. In 1819, a patriotic solicitude prompted an artist to visit him at his dwelling on the banks of the Missouri. Boone was found in a rude log-cabin, ill, and lying on his bed. A slice from the loin of a buck, twisted around the ramrod of his rifle, was roasting before the fire. His descendants occupied dilapidated cabins near by. He died of a fever in 1820, at the house of his son-in-law, in Flanders, Mo., at the age of eighty-nine years. Upon the announcement of his death the Legislature of that State, being in session, passed a resolution of respect to his memory, and voted that the members should wear the usual badge of mourning for thirty days.

At a session of the Legislature of Kentucky of 1844–5, measures were adopted to have the remains of Boone and his wife removed to the cemetery at Frankfort. This was done, and on September 13, 1845, the ashes of this venerable Western god were committed to their final repose. An immense concourse of people from all parts of the State was present on the occasion, and the ceremonies were deeply impressive. The hearse, decorated with evergreens and flowers, was drawn by four white horses. The pall-bearers were among the most distinguished military men of the State. A few years ago there was still standing, on the banks of the river, at Riverton, Ky., an old apple tree that Boone planted.


Monument to Daniel and Rebecca Boone, Frankfort, Ky. R. E. Launitz, Sculptor.

In the old graveyard near by the remains of his mother were believed to be buried. A large, square rock, inscribed, in plain but roughly-cut letters, D. B., 1775, was found in Mt. Olivet, five or six feet under ground, and between two posts standing perpendicularly in the ground. It is supposed that these initials were made by Boone, as he had spent some time in that neighborhood many years before.

The Boone Monument Association was incorporated by an act of the Legislature in 1848–9, for the purpose of erecting a memorial that should "manifest to the world the respect and gratitude of the descendants of the pioneers of Kentucky to those who first braved the perils of the dark and bloody ground." It was further enacted that "it was meet and proper that all the citizens of the State should have an opportunity of testifying their respect to these distinguished pioneers," Daniel and Rebecca Boone, his wife.

The monument was built in 1859, of Kentucky stone, by John Haly, of Frankfort, after a design by Robert E. Launitz, of New York, and at a cost of $2,000.

It was placed over the graves of those to whom it was erected, in the midst of and beneath the over-reaching branches of large trees, and in a picturesque spot in the Frankfort cemetery. From it stretches out one of the most commanding views of the city.

The four bas-reliefs, in Italian marble, were executed by Mr. Korwan, for the designer of the monument and under his directions. Of both Korwan and Launitz we shall speak at length in another place.

Bas-relief, Number 1, represents Boone sitting at the door of his cabin.

Number 2. First meeting of Boone and Simon Kenton.
Number 3. Fight with Indians.
Number 4. Peaceful pioneer life.

The simple inscriptions on the monument are "Daniel Boone" and "Rebecca Boone." Of its character we have only to say that it is good, and of the sculpture, that it is the best that could be made in this country at that time. We wish that we could add that the irreverent relic hunter had passed it by.

The following beautiful lines from a poem by the late Col. Theodore O'Hara must close this short account of one of the bravest and most attractive characters in all early American history, and to the memory of whom a great State may well pay its grateful tribute, and to its own honor watch over a precious inheritance:

"A dirge for the brave old pioneer,
Knight errant of the wood:
Calmly beneath the green sod here,
He rests from field and flood.
The war-whoop and the panther's screams
No more his soul shall rouse;
For well the aged hunter dreams
Beside his good old spouse."

ELISON WILLIAMS.

Near the Boone monument is a plain headstone bearing the following inscription: "Elison Williams, the friend and companion of Daniel Boone, born April 19, 1766, in North Carolina. Died August 11, 1850, in Kenton County, Ky." Williams's devotion to Boone's memory was touchingly shown in his barefoot walk from Kenton County to Frankfort, in 1844, to act as one of the pall-bearers on the occasion of the re-interment of the remains of his comrade-pioneer. At his death he requested that his body should be buried near the grave of Boone. The Legislature passed an act in accordance with this wish, and erected in 1860 the above mentioned stone, at a cost of $50.

SIMON KENTON.

Simon Kenton was a principal actor in almost every important event that occurred in Kentucky until Indian aggressions were entirely quelled, which was about 1793. He was born, of obscure parentage, in Virginia, May 15, 1755. His father was an Irishman, and his mother of Scotch descent. A full account of his life would fill a volume, and exceed in thrilling scenes, tragic situations and human incidents the most vivid and fertile imaginings of the novelist. Like Boone, he was mercilessly followed by misfortune in his old age, and was finally arrested for debt, and for twelve months lay in a prison upon the very spot where he built his cabin, and planted the first corn in Kentucky. After much suffering he prevailed upon the Legislature to release the claims of the State upon his lands, in 1824. Soon after Congress granted him a pension of $240 a year, in order to secure his old age from absolute want.

He died in April, 1836, in sight of the place where, fifty-eight years before, the Indians proposed to torture him to death. No monument marks his grave.

HENRY CRIST.

In the same cemetery that contains the Boone monument there is

[1] Continued from page 160, number 588.

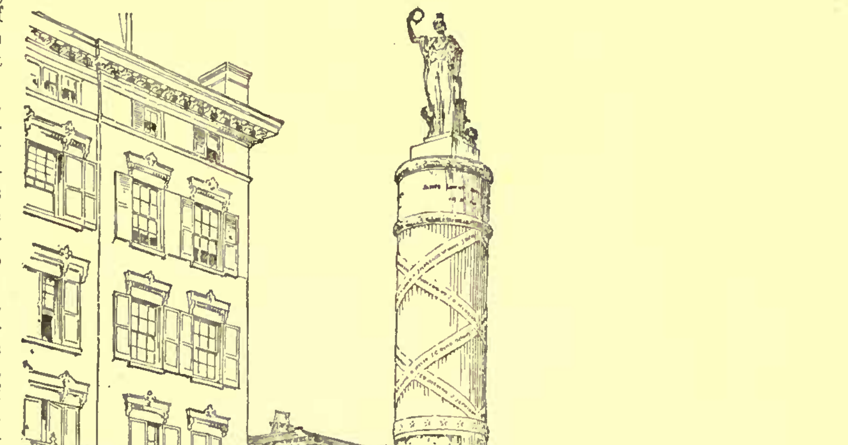
a simple memorial, also erected by the State, to the memory of Henry Crist, another pioneer whose enterprise and daring adventures largely contributed to the eventual prosperity of the settlements about Salt River and the Falls of Ohio. He was born in Virginia. While on a trip from Louisville down the Ohio and up Salt River on a flat-boat loaded with an outfit for his salt-works, he, with his party of thirteen, was suddenly attacked by a band of one hundred and thirty Indians at Rolling Fork. Nearly the entire party was killed, including Christian Crepps. Crist was shot in the heel, but the wound, unlike that of Achilles, did not prove mortal. The injury deprived him of the power of locomotion, and he lay down in the woods seven or eight miles from his camp to die. Finally, conquering his extreme pain and despair, he began to crawl toward the camp, trailing his journey with his blood as he cautiously and laboriously moved along. When almost in sight of the camp he fell exhausted, and made up his mind that death was inevitable. But a long and useful life was still in store for him. A settler chanced to pass near him, whom he managed, in a feeble voice to attract to his side. He was carried to the camp, and in after years became a member of the Legislature, and in 1808 a member of Congress. He died in Bullitt County in 1844, at the age of eighty years.

It is a recognized fact that the Frankfort cemetery contains not only many records of the history of Kentucky, but is an impressive evidence of its affection and gratitude for the men who have made her glory and her history. We do not know of another cemetery in the United States that can compare with it in State recognition of private and public worth. Its natural beauty is unsurpassed. It is situated on a hill more than two hundred and seventy-five feet above the city, which lies directly at its foot, to the westward. The beautiful poem of "The Two Villages," by Mrs. Rose Terry Cooke, has often been taken as a description of Frankfort and its cemetery; one verse we quote:

"Over the river, on the hill,
Lieth a village white and still;
All around it the forest trees
Shiver and whisper in the breeze;
Over it sailing shadows go
Of soaring hawk and screaming crow,
And mountain grasses low and sweet,
Grow in the middle of every street."

BALTIMORE MONUMENTS.

The city of Baltimore has long been popularly called, for several reasons, "The Monumental City." It built the first monument in memory of Washington; it caused to be executed the first statue in America of the Father of his Country; and it erected the first large military monument in the United States, as well as many other monuments to the memory and patriotism of its soldiers and sailors. Its devotion to and ready acknowledgment of the valor of its warrior sons has not been equalled by any city or State in the Union.



The Battle Monument, Baltimore, Md. Designed by J M. M. Godefroy,

BATTLE MONUMENT.

The smoke had hardly cleared away above Stony Point and Fort McHenry, and the blood, shed so bravely by the citizens of Baltimore, had barely become a part of the earth where it fell, before the corner-stone of a monument was laid.

The battles of Stony Point and Fort McHenry were fought on the 12 and 13 of September, 1814. The first meeting of the Committee of Safety, held to consider the subject of erecting a monument in commemoration of those events, was held March 1, 1815. Public subscriptions were called for with the provision that they should be limited to not more than five dollars to each subscriber. The corner-stone, containing the original subscription-paper, was laid September 12, 1815. The design of the monument was made by J. M. M. Godefroy. The procession of military and civic bodies that formed part of the ceremonies of laying the corner-stone, had, for a distinctive feature, a funeral-car, surmounted by a plan of the intended monument and drawn by six white horses, richly caparisoned, and led by six men in military uniform, guarded by a company of soldiers. During the procession minute-guns were fired, the church bells were rung muffled, and all business was suspended.

"The shaft of the Monument presents a *fasces*, symbolical of the Union; the rods are bound by a fillet, on which are inscribed the names of the heroes killed, because by their glorious death they strengthened the bands of the Union. The fasces is ornamented at the bottom on the north and south fronts with the bas-reliefs, one representing the battle of North Point and death of General Ross; the other the bombardment of Fort McHenry. On the fronts, east and west, are lachrymal urns, emblems of regret and tears. On the top are wreaths of laurel and cypress, expressive of glory and mourning. Each centre of the Egyptian cornice is adorned with a winged globe; the globe represents Eternity, the wings, Time. The edifice is entirely of marble, surmounted by a colossal statue, representing the City of Baltimore: in one hand is a rudder, emblem of Navigation; in the other she raises a crown of laurel as she looks toward the field of battle. The Monument, without the statue, is 42 feet 8 inches high, and the statue 9 feet 6 inches high." The latter is the work of Antonio Capeleno.

The following inscription appears on the monument:

BATTLE OF NORTH POINT
Sept 12th, A. D. 1814, and of the Independence of the U. S. the 39th.
BOMBARDMENT OF FORT McHENRY.
Sept. 13th, A. D. 1814.

The monument was completed in December, 1825, at a cost of nearly $60,000.

The committee that erected this statue was not as hesitating and reserved in its feelings as were the men who made the Groton Monument, as this extract from their address to the people of Baltimore will show:

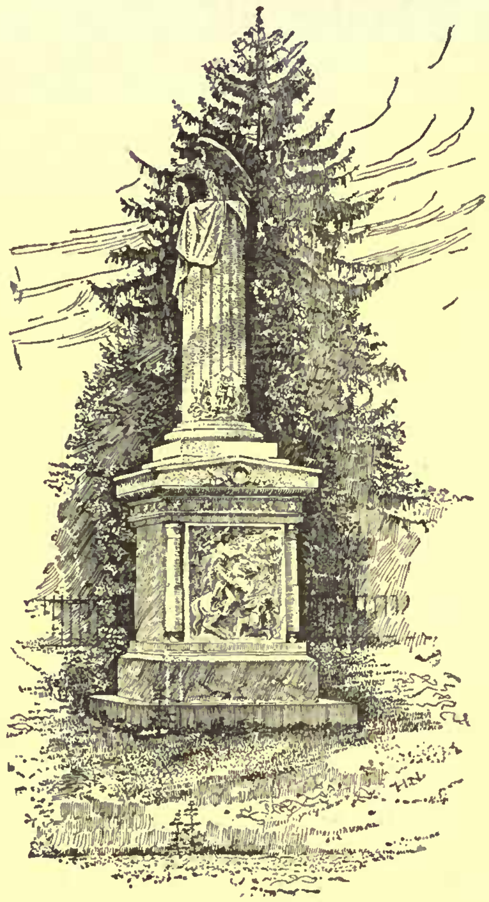
"To pay public honors to the memory of those who have fallen in defence of their country has been the usage of every age; and is recommended no less by sound policy than by gratitude, love of country, and all the most exalted feelings of our nature. The honors bestowed on our dead are the noblest incitements to virtuous deeds by the living."

Curious as this monument is, as a conglomeration of styles, symbols and emblems, it would have a right to claim exemption from criticism in consideration of the times in which it was erected, were it not for the existence of the Washington Monument in the same city, the corner-stone of which was laid in the same year. The latter structure has, as we shall find on further examination, certain art elements, harmonious and impressive. The Battle Monument is incongruous, and the part above the eagles is not impressive. Enlarged symbols and emblems, however touching in their significance, cannot perform the functions of architecture.

The Johnson Monument, at Frankfort, Ky., is the best specimen of this style to be found in this country, nor do we know of a better one anywhere.

If all the feelings growing out of the occasion could have made this monument a work of art, it certainly would have been one, for they were all there in the hearts of the grateful Committee of Safety and of the citizens generally. If the Washington Monument is to be taken

as an example of the art-intelligence of the people of Baltimore at the time of its erection, then the Battle Monument must be regarded as an expression of their weaker moments. For the former is not only a good monument for the time in which it was built, but it is the only columnar monument in the whole country, as well as the only monument in Baltimore, that is entitled to any serious thought. We



Johnson Monument, Frankfort Ky, R. E. Launitz, Sculptor.

suspect that the real facts of the case are, that its existence is due solely to its designer, and not to the people, and that if a weak man had been in his place a second Battle Monument would have been erected. It is a fact in the history of art, not so generally remembered as it ought to be, that art is not produced without artists, and that, in the United States especially, the people, when left to themselves, or when they take it upon themselves to procure art, are not apt to choose the best. From an art point of view Baltimore owes more to the fortuitous existence of the designer of the Washington Monument than to its own intelligence, for its reputation as the "monumental city."

WASHINGTON MONUMENT.

The subject of a monument to commemorate the last act of the military life of Washington, the resignation of his commission at Annapolis, was considered by the citizens of Baltimore as early as 1809. To assist in paying the cost of such an undertaking the Legislature passed an act in that year authorizing a number of gentlemen to raise $100,000 by lottery. The corner-stone was laid July 4, 1815, by the Freemasons of the State and attended by the most extraordinary military and civic ceremonies, both in extent and character. It was intended to erect the monument on the spot occupied by the Battle Monument, but as many of the wealthy citizens had erected costly dwellings around the square, they were afraid that the contemplated high structure might fall, and thus destroy valuable property and perhaps life, so a friend of Washington's, Col. J. E. Howard, gave the site it now occupies, which, at that time, was covered with trees, but is now surrounded by a square measuring two hundred feet on each side. The design of the monument was made by Robert Mills, of Charleston, S. C., and it was constructed under his supervision. It is described as representing a Doric column twenty feet in diameter at the base, fourteen at the neck, and one hundred and twenty feet from base to top of capital. The base upon which the column stands is fifty feet square and twenty-five high. The whole height, including the statue, which is sixteen feet high, is one hundred and eighty feet. The monument was completed and the statue placed in position December 25, 1829. It is built entirely of white marble on the outside and of brick on the inside, and stands two hundred and eighty feet above tide water. The base is arranged for the reception of statues and busts, and contains a bust of Washington, representing him in his youth, and the plaster model, seven feet high, of the statue which surmounts the column.

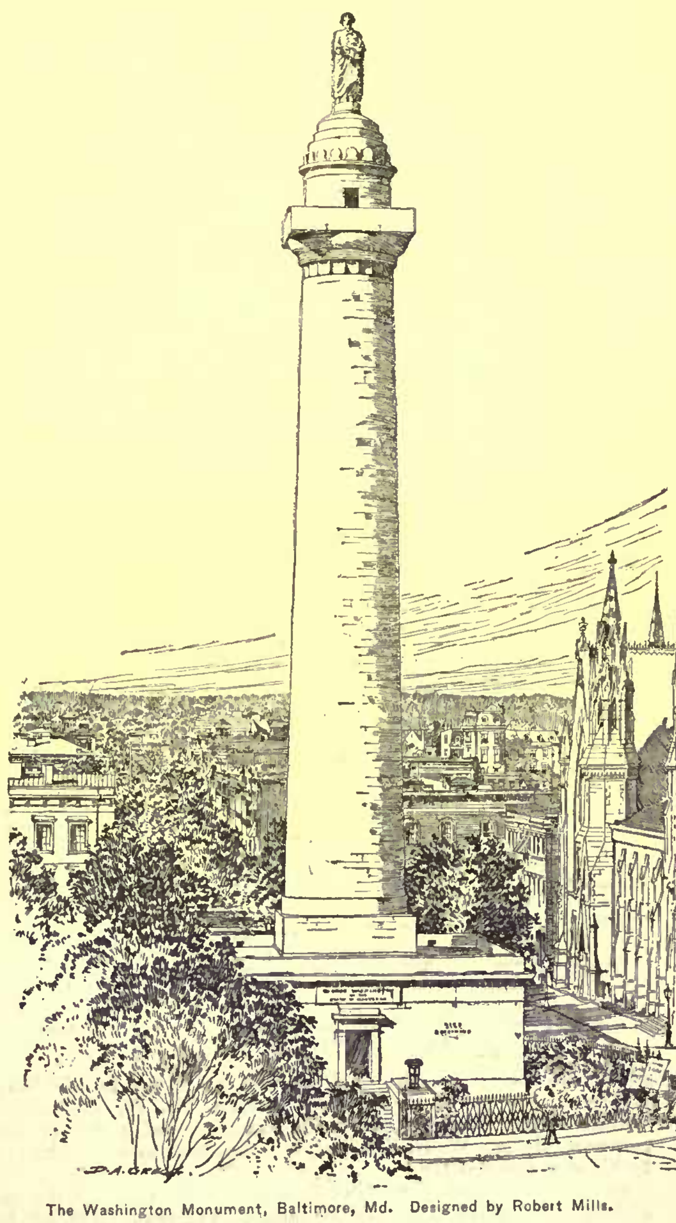
A circular stairway of two hundred and twenty-eight steps leads to the top.

The inscription, curiously divided into four parts, is placed upon the different sides of the base, and reads as follows:

TO
GEORGE WASHINGTON,
BY THE
STATE OF MARYLAND.
Born, February 22, 1732.
Commander-in-Chief of the American Army, June 15, 1776.
Trenton, Dec. 25, 1776. — *Yorktown, October* 19, 1781.
Commission resigned at Annapolis, Dec. 23, 1783.
President of the United States, March 4, 1789.
Retired to Mt. Vernon, March 4, 1797.
Died, December 14, 1799.

The statue represents Washington in the act of resigning his commission as General-in-chief of the Armies of the United States. It was made by André Causica, a Veronese sculptor, who had been employed in Washington in the execution of some bas-reliefs, and cost $17,000. The expense of its erection was $3,000. The cost of the entire monument was $200,000.

From an art point of view the Washington Monument is not only the most impressive structure of its kind in America, but it is freer from architectural faults than any other. Both of these points of superiority are due to the facts that a column ranks higher as an architectural form than an obelisk; that it will bear almost an endless enlargement, which the obelisk will not; and that, because of the higher art principles of its construction and nature, it will sustain



The Washington Monument, Baltimore, Md. Designed by Robert Mills.

more imperfections in its proportion and construction than the obelisk. The selection of a columnar monument on the part of the architect directly evidences his superior judgment and taste, and indirectly those of the committee that accepted it. Properly speaking, it is not a Doric column, but is a column-monument in the basic principles of its design; it belongs among the best examples of its kind in the world, unfortunately limited to only one superior example, that of the column of the Bastille.[1]

[1] See *American Architect* for June 25, 1881.

The genius of the architect deserves commendation for many reasons. He designed for the future: a fact so great and so seldom seen, perhaps we ought to say permitted, in this country, that it assumes an interest so gratifying that we are disposed to dwell upon it as though it were a new thing in the world. The site of the monument when it was first erected was in the middle of a wood far outside of the town, but now in the centre of the city. The architect took the largest view of his idea, that of a monument to be surrounded by a large space. He kept within the strictest limits of severity and dignity. These facts alone will preserve its claims to distinction, and entitles Baltimore to be regarded as the monumental city of the Union. It is a curious fact, though not an unexpected one in view of the monumental tendencies of the last twenty-five years, that the important architectural elements of the Washington Monument should have been completely ignored in all the column-monuments erected in this country. Not only ignored in these innumerable later-day structures, but in their stead are found all the faults that an evil ingenuity could conceive.

No lesson, suggestion, or involved art-principle has been derived from the Baltimore column. All the principles and purposes of a column-monument have been so degradingly subordinated, as may be seen in the illustrations of column-monuments erected in this country, that one is forced to think that art occupies a very small place in their design and purpose. The worst example of all is the Yorktown Monument.[1] Even Baltimore, with all its high sentiments of gratitude and enthusiastic patriotism, the Washington column, as a kingly point of departure, and the reputation it justly gives to the city to support, has steadily gone backward instead of forward in its monumental expressions. Its accessory claim to distinction, as shown in the Barye groups, is due to its distinguished citizen, Mr. W. T. Walters. Though it has produced a sculptor who possessed a rare art-temperament, the late W. H. Rienhart, it is enriched by his works only by his own generosity.

In the Washington Monument it undoubtedly employed the best architect then living in the United States. The shame is that it has neglected to follow that precedent.

It should not be forgotten that the Stars and Stripes waved for the first time in October, 1775, in the harbor of Baltimore. Thirty-nine years later Francis S. Key wrote the "*Star Spangled Banner*," while a prisoner on board the British fleet on the morning after the bombardment of Fort McHenry. On Defender's Day of 1876 the last survivor of the battle, James C. Morford, aged ninety-one years, made his usual promenade around the Battle Monument, and saluted the shaft erected to the memory of his dead comrades.

T. H. Bartlett.

[To be continued.]

[1] See *American Architect* for October 15, 1881.

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE ON BELLEVUE AVENUE, NEWPORT, R. I.

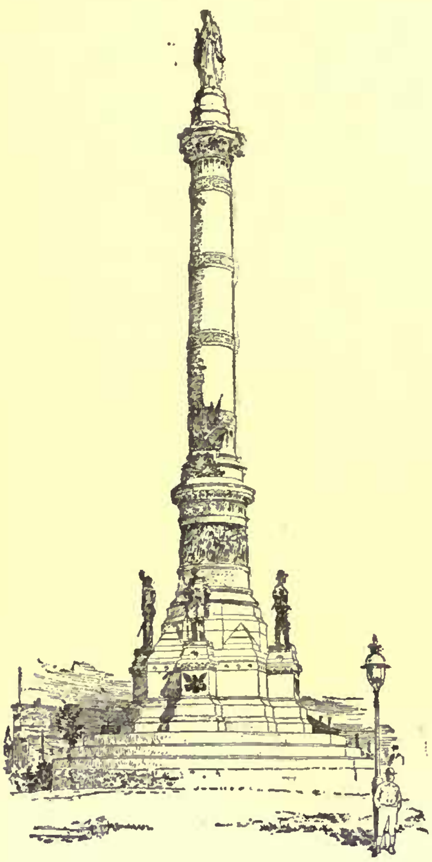
[Gelatine Print, issued only with the Imperial Edition.]

PORTIONS OF THE NEW FACADE OF S. MARIA DEL FIORE, FLORENCE, ITALY.

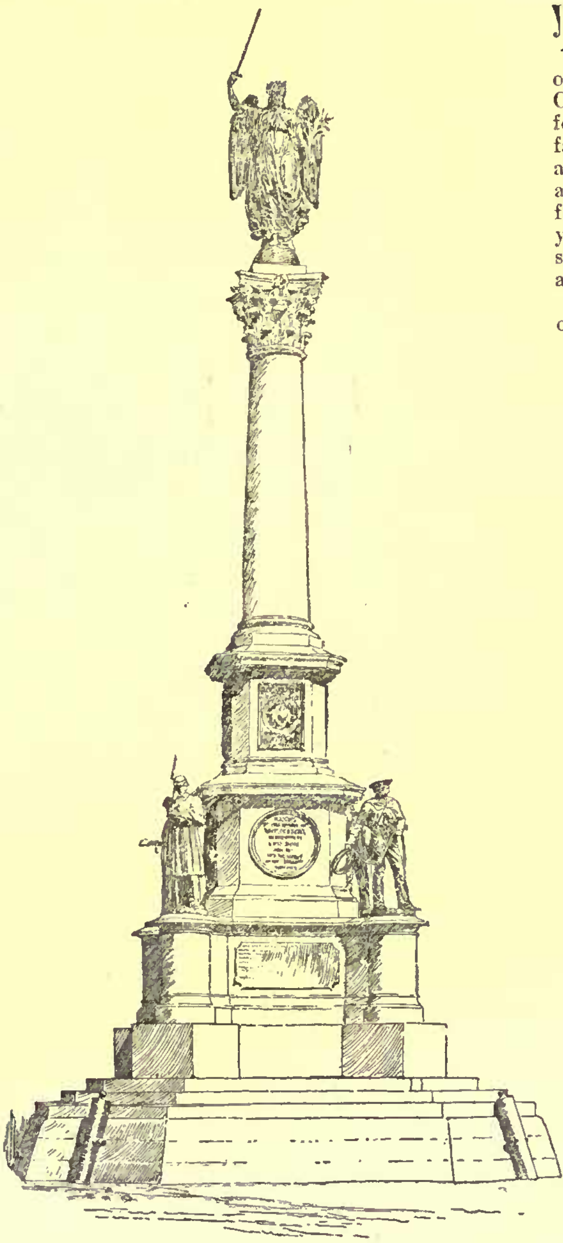
Through the kindness of Mr. W. P. Garrison we are able to publish views of two portions of the new façade of the Florence Cathedral, the presence of the scaffolding bearing testimony to the fact that the negatives were taken at the earliest opportunity. An attempt to do justice to the entire façade in one view would have yielded a result many times less satisfactory than even these details afford.

The mosaic-work in the lunette over the central door is the work of Prof. Niccolò Barabino, and represents the Virgin praying before her son. Other figures are those of St. John the Baptist, St. Anna, St. Lorenzo, St. Vittorio, St. Mary Magdalen, Pius IX, and others. The bas-relief in the tympanum above is the work of Prof. A. Passaglia, and represents the Virgin blessing the Christian world. The figures on either side are St. Catherine of Sienna, Calixtus III, Christopher Columbus and his friend Fra Giovanni Perez, Queen Esther, the Prophetess Deborah, Pius V, the Gonfaloniere and Prior of the Florentine Republic, who caused the cathedral to be built. In the spandrels on either side are shown some of Gideon's trumpeters assaulting the walls of Jericho.

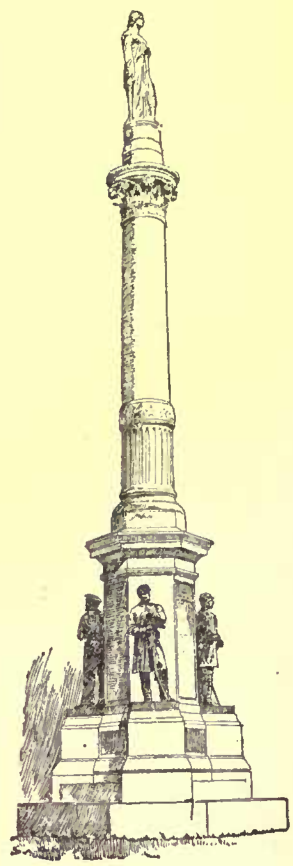
The mosaic-work over the right-hand door is also by Prof. Barabino, and represents the "Triumph of Charity," the figures represented being those of the founders of various Florentine charitable institutions. The "Ecce Homo" in the tympanum above is by Professor Passaglia. The two large figures of Fathers of the Church



Soldiers' and Sailors' Monument, Buffalo, N. Y.
George Keller, Architect.



Army and Navy Monument, Worcester, Mass.
Randolph Rogers, Sculptor.

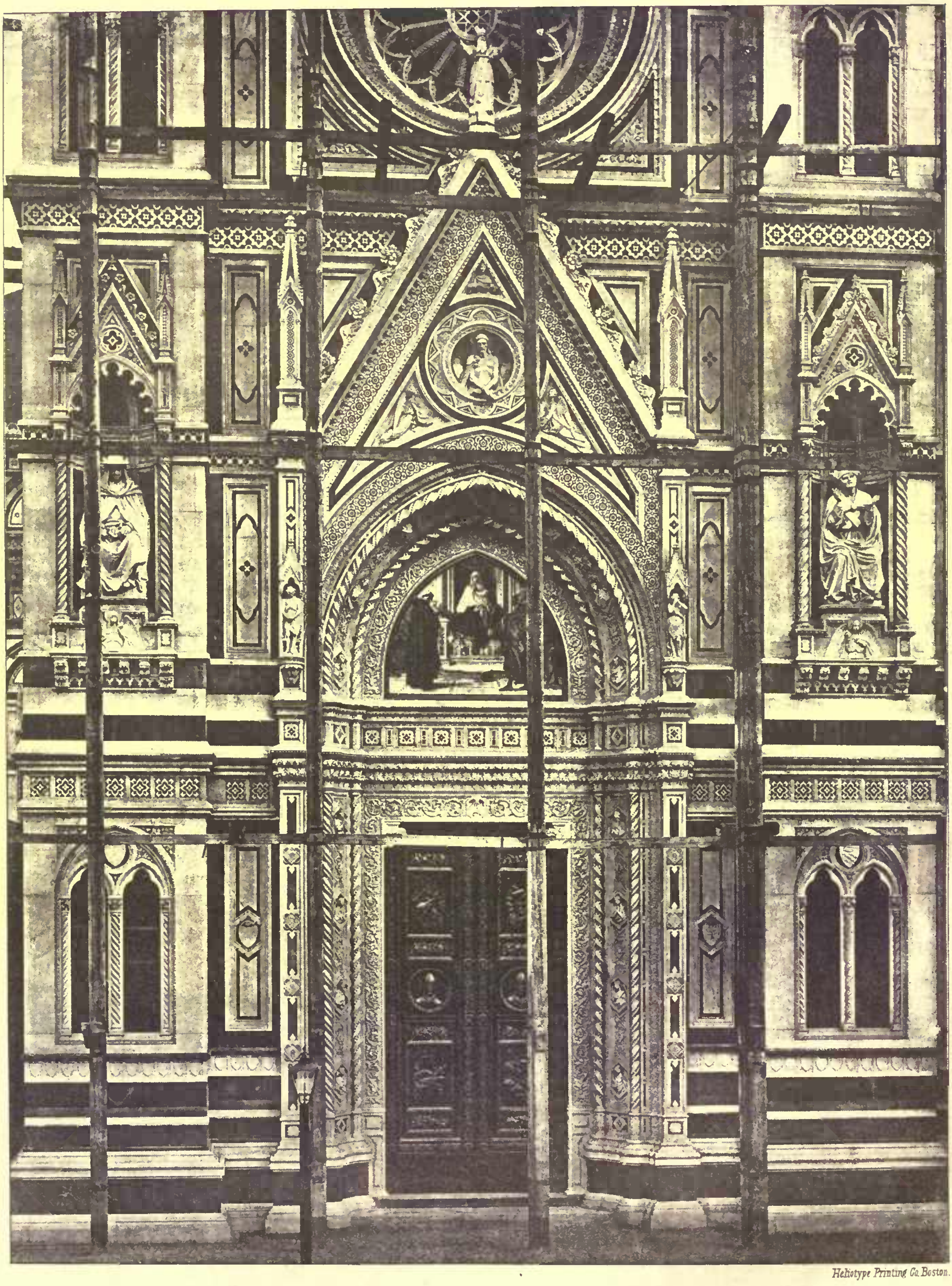


Soldiers' Monument, Lawrence, Mass.
Designed by M. J. Powers.



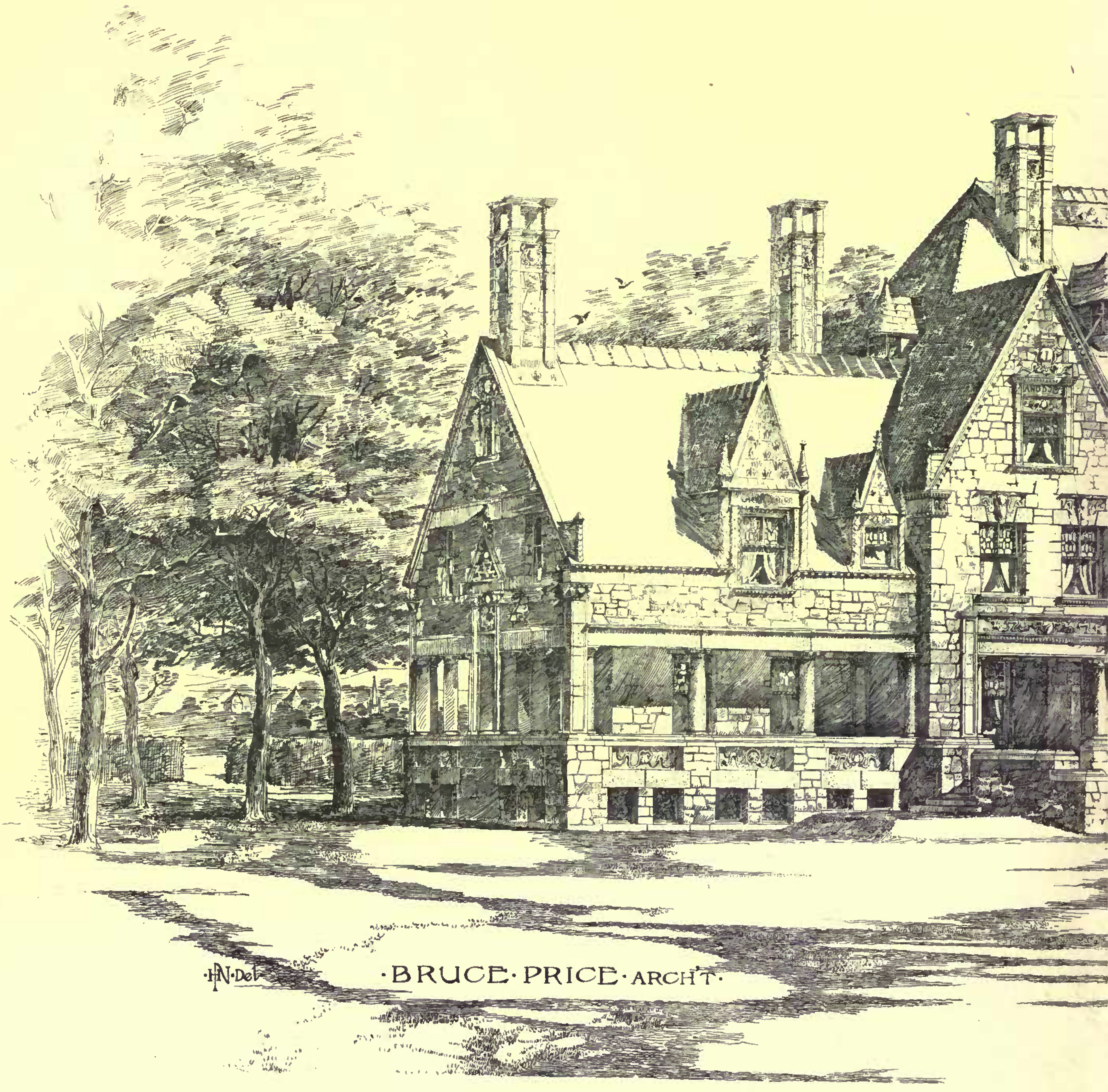
· CHADWICK · LEAD · WORKS ····· BOSTON ·

Heliotype Printing Co. Boston



Heliotype Printing Co. Boston.

Right hand Doorway; S. Maria del Fiore; Florence.

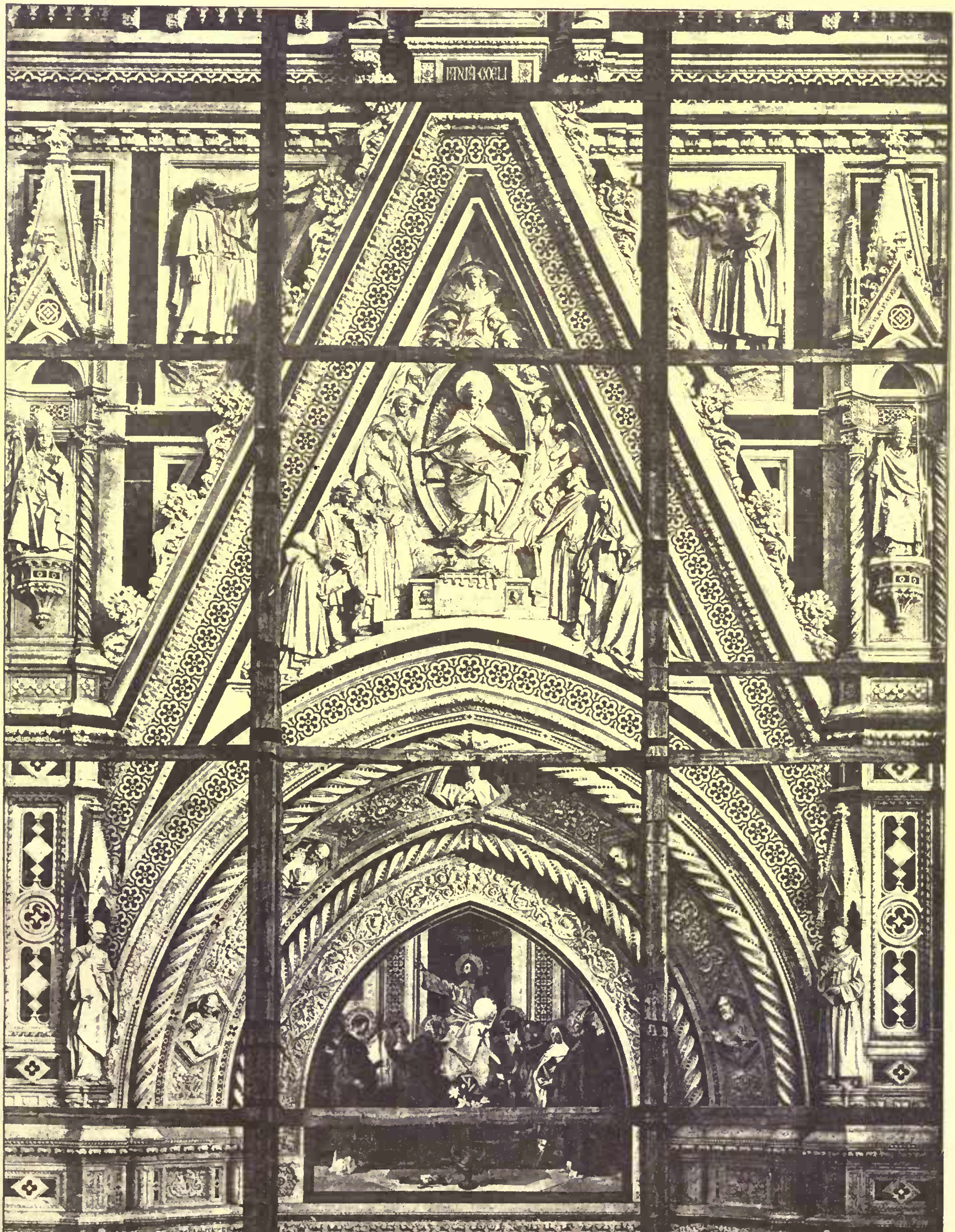

H.N. Del
·BRUCE·PRICE·ARCH'T·

ICKNOR & Co



·STONE-ACRE·

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Detail of Main Entrance S. Maria del Fiore: Florence.



Heliotype Printing Co. Boston.

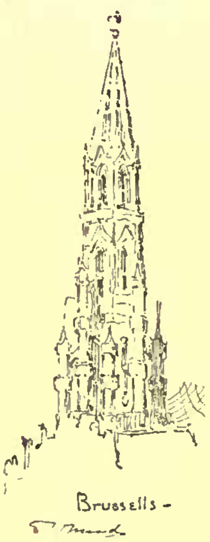
in the large niches are by Dante Sodini, and the two small figures of Adam and Eve at either side of the central mosaic are by Prof. L. Torelli.

DESIGN FOR THE UNITED STATES COURT-HOUSE AND POST-OFFICE, DETROIT, MICH. MR. M. E. BELL, SUPERVISING ARCHITECT, WASHINGTON, D. C.

THE CHADWICK LEAD-WORKS, BOSTON, MASS. MR. W. G. PRESTON, ARCHITECT, BOSTON, MASS.

"STONE ACRE." MR. BRUCE PRICE, ARCHITECT, NEW YORK, N. Y.

S. MARIA DEL FIORE.



AMONG the developments of this age, so rich in the conception and carrying out of grand schemes, is a spirit of completing things which, striding from country to country of the Old World, is putting its stamp on so many time-honored and noble edifices hitherto beautiful indeed and majestic, but wanting in some important feature included in its design. The most conspicuous illustration of this is the Cologne Cathedral which, more than six hundred years after the laying of its foundation-stone, saw completed, a few years ago, as if by magic, its noble towers. About the middle of this century Rouen put a similar finishing-touch to her twelfth-century cathedral, and pierced the skies with perhaps the most airy and beautiful [!] spire ever constructed, a perfect marvel of stone-lace [iron] drawn up into the air to the not-contemptible height of four hundred and eighty-seven feet. In the same city also the scarcely-less noble monument, the venerable Church of St. Ouen received, a few years since, its beautiful and tasteful façade, and stands now. in every part, one of the most perfect specimens of Gothic architecture in existence. The same spirit in England has made, or is making, its mark on many a grand old thirteenth-century cathedral. This very year, and in the early part of the month of May, Italy is to step to the front and exhibit to the world a long-deformed structure — in spite of its deformity one of the grandest and most beautiful in Europe — completed.

The cathedral at Florence, so long wanting in that essential feature a face, has, within the last few years, been acquiring one which is to be unveiled to the public on the 12th of May. Travellers in Italy some twelve or fifteen years ago were often pained, in making the circuit of this almost incomparably majestic and beautiful pile of many-colored marbles, to find, at the very next step after passing the tower of Giotto and immediately confronting the simple and majestic baptistery, a grim, rough wall and nothing more! "Why is this?" has been the query of thousands of travellers. When the cathedral was begun, with Arnolfo, son of Cambio, as architect (who laid the foundation-stone in 1294 and continued the work until his death, in 1310), the façade grew with the rest and in the same character as the lateral exteriors, that is, faced with colored marbles; but for the sake of harmony and repose, and perhaps in order to leave the climax for the dome, it was not ornamented in any way superior to the other parts of the exterior. After Arnolfo's death, work was entirely suspended for many years, until finally, in 1334, Giotto, who, about this time, had become the successful competitor for the bell-tower, and had laid the foundation-stone of his tower, was chosen architect, and work was resumed. Giotto, however, never saw erected more than a few metres of the base of the beautiful tower which bears his name — to say nothing of the cathedral — as he died two years after its commencement, but it was finished after his model. The architects who succeeded him, and the building authorities, on comparing the tower with the sober face of the cathedral, decided to change Arnolfo's plan, and accordingly proceeded to build outside of his front another that corresponded with the tower. This façade, as described by the historian and architect Rondinelli (1600), and by others, was very beautiful, a statement which, with the tower before one's eyes, it is not difficult to believe. About one-third of this face only was completed. Rondinelli says it was full of beautiful niches for statuary, upon which the most celebrated sculptors of the time, Donatello and others, had already been at work. There were numerous chapels (recesses), divided and supported by variegated columns, some smooth, some twisted, so that with all this variety of form and color the whole was rich and majestic in the extreme. For what reason the work never proceeded farther is uncertain. It is conjectured that the wall was thought to be too weak to support the heavy ornamentation. Work seems to have been suspended early in the fifteenth century. In this unfinished state the façade stood for about two hundred years the admiration of artists and travellers in Italy.

In the year 1588 the Grand Duke Francesco (Medici), who wished to imitate his father, Cosmo, in doing great things for Florence, called for models for a new façade, and meanwhile to clear the way for it, he set the Architect Buontalenti to tearing down the Giottesque façade, which was no longer considered to be in harmony with the rest of the cathedral, which, by the addition in the fifteenth century of the dome of Brunelleschi, had assumed a new and severe majesty. The description of Rondinelli of the tearing down of this front is touching. Buontalenti called together a number of master-workmen and offered the work of demolition to the one who would do it for the least money. The sacrilegious job was finally awarded for the sum of 225 scudi, a scudo being five francs. The deed was done in a most ruthless manner. Except the statues, everything was knocked to pieces, even the beautiful columns and carved marbles, so that the people, it is said, looked sorrowfully on. For some cause the zeal for a new façade died out, however, before a commencement could be made. The chief source of difficulty is said to have been in the number and variety of models furnished. Nothing suitable could be chosen. Some of these models have been preserved, and may still be seen at the Warden's rooms. Forty years later, in 1628, another attempt was made, but it likewise failed.

This ends the history of the marble fronts previous to the one to be unveiled early in May. Not so, however, with the painted ones, of which the structure has had no less than four. The first was put up about 1515 for the reception of Pope Leo X in Florence, in preparation for which event Andrea del Sarto was ordered to paint a façade on wood which was to be set up over the incomplete one of Giotto. This he did, with the help of Sansovino and other artists, according to Vasari, and with great skill, painting in light and shade pillars, bas-reliefs, and statues one story above another. The Pope praised it, and there was talk of its being carried out in marble, but with the departure of the Pope this zeal also departed. Nothing further was done. The second temporary façade was a linen one (1589) set up one year after the destruction of the Giottesque one of marble. The occasion was the marriage of the Grand Prince Ferdinand I. It was afterward used for decorating the doors of the interior, where it remained until 1847. The third painted façade (1661) was also of linen. It was made for the marriage of the Grand Prince Cosmo with the Bourbon Princess Louise, daughter of the Duke of Orleans. The painter of this (probably Rondinelli), in order to flatter the French Princess, made a series of pictures in which her countrymen figured, including scenes from the life of St. Clotilde, St. Louise of Cluis, and Charlemagne. Fortunately, not long after it had done service at the wedding, this façade was torn to pieces and blown away by a wind tempest. The fourth and last of the painted façades was also made for a royal wedding, that of Cosmo III's son Ferdinand, in 1688. This time the wall itself was painted on, the ragged surface having been covered with a suitable coat of plaster for the purpose. Upon this were painted in fresco over the central and each of the lateral portals, immense pictures representing the three great Papal councils held at different periods in the cathedral. The coat of plaster remained intact until 1870, when its destruction was begun as the initiatory step for the façade now completed. The rain had carried away the last vestige of the pictures long before.

So much for the history of past façades. About fifty years since, after one hundred and fifty years of entire silence, the architect Metas, who had just succeeded in constructing a very handsome façade for the church of the Santa Croce, aroused fresh interest in the subject of a new one for the cathedral. It was firmly resolved to proceed in the matter, and a corner-stone was laid in May, 1860, under the auspices of Victor Emmanuel, who had just then become King of Italy. The next day his treasurer was authorized to subscribe 100,000 francs as the gift of the King from his private funds. It was seven years, however, in spite of the almost constant study of more than two score of architects, before a plan was chosen, and Emilio de Fabris, then professor of architecture in the Academy of Fine Arts in Florence, was appointed architect. Of the nine styles of models which, at various times, had been sent in by competitors, two styles alone admitted of consideration — the Basilical and the Gothic — the question of the two hinging particularly on the crowning of the front. If the cathedral at its conception and birth was Gothic it was because at that time any other style of temple for religious worship could scarcely have found an architect in Europe. Something was needed which combined severe grandeur with genial loveliness, a style, in short, in which the dome of Brunelleschi and the tower of Giotto should find each an echo. What was chosen at last was a thoroughly Gothic plan from foundation to pinnacle, very rich in ornamentation, but with much dignity in treatment.

The appointment of de Fabris as architect was the beginning of a seven or eight years' architectural war that divided Florence into factions quite as noisy, if not as bloody, as the Bianchi and Neri, or the Guelphi and Ghibellini of old. In 1873 de Fabris, who, during the six years since his appointment, had been hard at work making preparations, and had made no reply to any attack, finally broke silence, and in a published letter to the deputation said one would suppose by the articles in the journals that the end of the world would come if the Ministry and all others in authority did not come together *in masso* and prevent the tearful misfortune of seeing the tricusped system crown the future façade of Santa Maria del Fiore. Then, by drawings, he illustrated the consistency of his plan.

In 1870 a commencement was made by the removal of the coating upon which the 1688 frescos had been painted, thus laying bare the wall for the application of marble, and finally, in December, 1875, the scaffoldings and screens were erected, and the work was actually under way. In 1879 the left side, about one-quarter of the whole front, being completed, except the crowning-point, was uncovered and universally applauded. After this the work went on pretty smoothly until 1883, when the death of the architect, de Fabris in

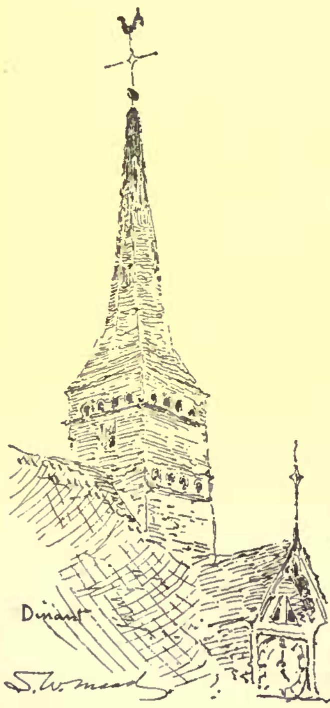
June, effected another change in the history of the facade. The whole being by this time finished up to the same line as the part which had been exhibited, it was decided to finish the top in wood, painted to imitate the marbles, one-half in the basilical and the other in the tricusped style, and then to uncover the whole front with due solemnities. This plan, under the auspices of the architect del Moro, who had been appointed to succeed de Fabris, was carried out, and basilical or tricusped was now the great question. There was not a baker's boy or an apprentice sewing-girl in Florence who did not for the time feel that the whole weight of the façade question rested on him or her for solution, and "*basilicale o tricuspidale?*" was discussed by them over polenta or hard bread and salami, as though such architectural terms were something with which they had always lived on familiar footing. The peo,le were quite unanimous in favor of the tricusped style, but the basilical, alas! finally triumphed, and in this style the work has been finished. In a few days we shall see what the effect of the whole is, and it will certainly be a fortunate circumstance if in the Gothic front of de Fabris there are no strong leading chords which do not find a perfectly happy solution in the crowning basilical work of del Moro.

The festivities on this occasion are to be on the grandest scale. All Florence has been for weeks topsy-turvy in getting ready, and if ever she merited the name of "Firenze la bella" it will be when, with all her streets (which needed it) newly-paved and everything respl ndently clean, beflagged and beflowered, she is in full dress for the ceremonies. As for the cathedral, it the advice of the Circolo Artistico is carried out, it is to be wreathed in its whole vast perimeter to the height of ten feet with flowers! For is not its name Santa Maria del Fiore? and is not the name of the city Firenze? On the night after the uncovering of the façade every window in Florence is to be illuminated by municipal order, and colored transparencies of myriads of designs are already for sale. Those who are too poor to illuminate are to be supplied with materials by the municipality, so that not a window shall be left dark in the entire city. The festival is to last from the 4th to the 20th of May, inclusive. A grand international tournament, a grand historical ball, boat-races on the Arno, horse-races in the Cascine, grand processions of all kinds by day, and grand fireworks of all kinds by night — these are some of the features of the programme. — *New York Times.*

SAFE BUILDING.—XV.[1]

CHAPTER IV.

WALLS AND PIERS.



WALLS are usually built of brick or stone, which are sometimes, though rarely, laid up dry, but usually with mortar filling all the joints.

Object of mortar. The object of mortar is threefold:

1. To keep out wet and changes of temperature by filling all the crevices and joints.

2. To cement the whole into one mass, keeping the several parts from separating, and,

3. To form a sort of cushion, to distribute the crushing evenly, taking up any inequalities of the brick or stone, in their beds, which might fracture each other by bearing on one or two spots only.

To attain the first object, "grouting" is often resorted to. That is, the material is laid up with the joints only partly filled, and liquid mortar is poured on till it runs into and fills all the joints. Theoretically this is often condemned, as it is apt to lead to careless and dirty work and the overlooking of the filling of some parts; but *practically* it makes the best work and is to be recommended, except, of course, in freezing weather, when as little water as possible should be used.

To attain the second object, of cementing the whole into one mass, it is necessary that the mortar should adhere firmly to all parts, and this necessitates soaking thoroughly the bricks or stones, as otherwise they will absorb the dampness from the mortar, which will crumble to dust and fail to set for want of water. Then, too, the brick and stone need washing, as any dust on them is apt to keep the mortar from clinching to them. In winter, of course, all wetting must be avoided, and as the mortar will not set so quickly, a little lime is added, to keep it warm and prevent freezing.

Thickness of joints. To attain the third object, the mortar joint must be made thick enough to take up any inequalities of the brick or stone. It is, therefore, impossible to set any standard for joints, as the more irregular the beds of the brick or stone, the larger should be the joint. For general brickwork it will do to assume that the joints shall not average over one-quarter of an inch above irregularities. Specify, therefore, that, say, eight courses of brick laid up "in the wall" shall not exceed by more than two inches in height eight courses of brick laid up "dry." For front work it is usual to gauge the brick, to get them of exactly even width, and to lay them up with one-eighth inch joints, using, as a rule, "putty" mortar. While this makes the prettiest wall, it is the weakest, as the mortar has little strength, and the joint being so small it is impossible to bond the facing back, except every five or six courses in height. "Putty" mortar is made of lime, water and white lead, care being taken to avoid all sand or grit in the mortar or on the beds.

Quality of mortars. The best mortar consists of English Portland cement and sharp, clean, coarse sand. The less sand the stronger the mortar.

Sand for all mortars should be free from earth, salt, or other impurities. It should be carefully screened, and for very important work should be washed. The coarser and sharper the sand the better the cement will stick to it. English Portland cement will stand as much as three or four parts of sand. Next to English come the German Portland cements, which are nearly as good. Then the American Portland, and lastly the Rosendale and Virginia cements. Good qualities of Rosendale cements will stand as much as two-and-a-half of sand. Of limes, the French lime of Teil is the strongest and most expensive. Good, hard-burned lime makes a fairly good mortar. It should be thoroughly slacked, as otherwise, if it should absorb any dampness afterwards, it will begin to burn and swell again. At least forty-eight hours should be allowed the lime for slacking, and it is very desirable to strain it to avoid unslacked lumps. Lime will take more sand than cement, and can be mixed with from two to four of sand, much depending on the quality of the sand, and particularly on the "fatness" of the lime. It is better to use plenty of sand (with lime) rather than too little; it is a matter, however, for practical judgment and experiment, and while the specification should call for but two parts of sand to one of lime, the architect should feel at liberty to allow more sand if thought desirable. Lime and Rosendale cement are often mixed in equal proportions, and from three to five parts of sand added; that is, one of lime, one of cement, and three to five of sand. It is advisable to specify that all parts shall be actually measured in barrels, to avoid such tricks, for instance, as hiring a decrepit laborer to shovel cement or lime, while two or three of the strongest laborers are shovelling sand, it being called one of cement to two or three of sand. A little lime should be added, even to the very best mortars, in winter, to prevent their freezing.

Frozen walls. When a wall has been frozen, it should be taken down and re-built. Never build on ice, but use salt, if necessary, to thaw it; sweep off the salt-water, which is apt to rot the mortar, and then take off a few courses of brick before continuing the work. Protect walls from rain and frost in winter by using boards and tarpaulins. Some writers claim that it does no harm for a wall to freeze; this may be so, provided all parts freeze together and are kept frozen until set, and that they do not alternately freeze and thaw, which latter will undoubtedly rot the mortar.

Plaster-of-Paris makes a good mortar, but is expensive and cannot stand dampness. Cements or limes that will set under water are called hydraulic.

Quickness of setting is a very desirable point in cements. All cement-mortars, therefore, must be used perfectly fresh; any that has begun to set, or has frozen, should be condemned, though many contractors have a trick of cutting it up and using it over with fresh mortar. To keep dampness out of cellar-walls the outside should be plastered with a mortar of some good hydraulic cement, with not more than one part of cement to one part of sand; this cement should be scratched, roughened, and then the cement covered outside with a heavy coat of asphalt, put on hot and with the trowel. In brick walls, the coat of cement can be omitted and the joints raked out, the asphalt being applied directly against the brick. This asphalt should be made to form a tight joint, with the slate or asphalt damp-course, which is built through bottom of wall, to stop the rise of dampness from capillary attraction.

In ordinary rubble stonework the mortar should be as strong as possible, as this class of work depends entirely on the mortar for its strength.

For the strengths of different mortars, see Table V.

Some cements are apt to swell in setting, and should be avoided.

Smoke flues. Where flues or unplastered walls are built, the joints should be "*struck*," that is, scraped smooth with the trowel. No flues should be "pargetted"; that is, plastered over, as the smoke rots the mortar, particles fall, and the soot accumulating in the crevices is apt to set fire to the chimney. Joints of chimneys are liable to be eaten out from the same reason, and the loose portions fall or are scraped out when the flues are cleaned, leaving dangerous cracks for fire to escape through. It is best, therefore, to line up chimneys inside with burned earthenware or fire-clay pipes. If iron pipes are used, cast-iron is preferable; wrought-iron, unless very thick, will soon be eaten away. Where walls are to be plastered, the joints are left as rough as possible, to form a good clinch.

Wall furrings. Outside walls are not plastered directly on the inside, unless hollow; otherwise, the dampness would strike through and the plaster not only be constantly damp, but it would ultimately fall off. Outside walls, unless hollow, are always

[1] Continued from page 167, No. 588.

"furred." In fireproof work, from one to four-inch thick blocks are used for this purpose. These blocks are sometimes cast of ashes, lime, etc., but are a very poor lot and not very lasting. Generally they are made of burnt clay, fire-clay or porous terra-cotta. The latter is the best, as, besides the advantages of being lighter, warmer and more damp-proof, it can be cut, sawed, nailed into, etc., and holds a nail or screw as firmly as wood. These blocks are laid up independently of the wall, but occasionally anchored to the same by iron anchors. The plastering is applied directly to the blocks.

In cheaper and non-fireproof work, furrings are made of vertical strips of wood about two inches wide, and from one to two inches thick, according to the regularity of the backing. For very fine work, sometimes, an independent four-inch frame is built inside of the stone-wall, and only anchored to same occasionally by iron anchors. Where there are inside blinds, a three or four inch furring is used (or a fireproof furring), and this is built on the floor beams, as far inside of the wall as the shutter-boxes demand. To the wooden furrings the laths are nailed. Furrings are set, as a rule, sixteen inches apart, the lath being four feet long; this affords four nailings to each lath. Sometimes the furrings are set twelve inches apart, affording five nailings. All ceilings are cross-furred every twelve inches, on account of stiffness, and the strips should not be less than one-and-three-eighths inches thick, to afford strength for nailing. Furring-strips take up considerable of the strain of settlements and shrinkage, and prevent cracks in plastering by distributing the strain to several strips. To still further help this object, the "heading-joints" of lath should not all be on the same strip, but should be frequently broken (say, every foot or two), and should then be on some other strip. Laths should be separated sufficiently (about three-eighths inch) to allow the plaster to be well worked through the joint and get a strong grip or "clinch" on the back of the laths. If a building is properly built, theoretically correct in every respect, it should not show a single crack in plastering. Practically, however, this is impossible.

Shrinkage of joints. But there never need be any fear of shrinkage or settlement, in a well-constructed building, where the foundations, joints and timbers are properly proportioned. The danger is never from the *amount* of settlements or shrinkage, but from the *inequality* of same in different parts of the building. Inequalities in settlements are avoided by properly proportioning the foundations. Inequalities in shrinkage of the joints, though quite as important, are frequently overlooked by the careless architect. He will build in the same building one wall of brick with many joints, another of stones of all heights and with few joints, and then put iron columns in the centre, making no allowance whatever for the difference in shrinkage. If he makes any, it is probably to call for the most exact setting of the columns, for the hardest and quickest-setting Portland cement for the stonework, and probably be content with lime for the brickwork. To avoid uneven shrinkages, allowances should be made for same. Brickwork will shrink, according to its quality, from one-sixteenth to one-eighth inch per story, ten to twelve feet high, and according to the total height of wall. The higher the wall, the greater the weight on the joints and the greater the shrinkage. Iron columns should, therefore, be made a trifle shorter than the story requires, the beams being set out of level, lower at the column. The plan should provide for the top of lowest column to be one-sixteenth or one-eighth inch low, while the top of highest column would be as many times one-sixteenth or one-eighth inch low as there were stories; or if there were eight stories, the top of bottom column for the very best brickwork would be, say, one-sixteenth inch low, and the top of highest column would be one-half inch low. Stone walls should have stone backings in courses as high as front stones, if possible; if not, the backing should be set in the hardest and quickest-setting cement.

Slip-joints. Stone walls should be connected to brick walls by means of slip-joints. By this method the writer has built a city stone-front, some 150 feet high and over 50 feet wide, connected to brick walls at each side, without a single stone sill, or transom, or lintel cracking in the front. The slip-joint should carry through foundations and base courses where the pressure is not equal on all parts of the foundation. If for the sake of design, it is necessary to use long columns or pilasters, in connection with coursed stone backings, the columns or pilasters must either be strong enough to do the whole work of the wall, or else must be bedded in putty-mortar with generous top and bottom joints, to allow for shrinkage of the more frequent joints behind them; otherwise, they are apt to be shattered. Such unconstructional designs had, however, better be avoided. In no case should a wall be built of part iron uprights and part masonry; one or the other must be strong enough to do the work alone; no reliance could be placed on their acting together. In

Shrinkage of timber. frame walls, care should be taken to get the amount of "cross" timbering in inner and outer walls about equal, and to have as little of it as possible. Timber will shrink "*across*" the grain from one-fourth to one-half inch per foot. Where the outer walls are of masonry, and inner partitions or girders are of wood, great care must be taken that the shrinkage of each floor is taken up by itself. If the shrinkage of all beams and girders is transferred to the bottom, it makes a tremendous strain on the building and will ruin the plastering. To effect this, posts and columns should bear *directly* on each other, and the girders be attached to their sides or to brackets, but by no means should the girder run between the upper and lower posts or columns. If there are stud-partitions, the head pieces should be as thin as possible, and the studs to upper partitions should rest *directly* on the head of lower partitions.

All beds level. In masonry, all beds should be as nearly level as possible, to avoid unequal crushing. Particularly is this the case with cut stonework. If the front of the stone comes closer than the backing (which is foolishly done sometimes to make a small-looking joint), the face of the stone will surely split off. If the back of a joint is broken off carelessly, and small stones inserted in the back of a joint to form a support to larger stones, they will act as wedges, and the stone will crack up the centre of joint and wall. Stones should be bedded, therefore, perfectly level and solid, except the front of joint for about three-fourth inches back from the face, which should not be bedded solid, but with "putty"-mortar.

Cement stains. Light-colored stones, particularly lime-stones, are apt to stain if brought in connection with cement-mortar. A good treatment for such stones is to coat the back, sides and beds with lime-mortar, or, if this is not efficacious, with plaster-of-Paris.

Natural bed. All stones should be laid on their "natural beds"; that is, in the same position as taken from the quarry. This will bring the layers of each stone into horizontal positions, on top of each other, and avoid the "peeling" so frequently seen. Ashlar should be well anchored to the backing. The joints should be filled with putty-mortar, and should be sufficiently large to take up the shrinkage of the backing.

Size of stones. Stones should not be so large as to risk the danger of their being improperly bedded and so breaking. Professor Rankine recommends for soft stones, such as sand and lime stones, which will crush with less than 5000 pounds' pressure per square inch, that the length shall not exceed three times the depth, nor the breadth one-and-a-half times the depth. For hard stones, which will resist 5000 pounds' compression per square inch, he allows the length to be from four to five times the depth, and the breadth three times the depth. Stones are sometimes joined with "rebated" joints, or "dove-tail" joints, the latter particularly in circular work, such as domes or light-houses.

Sills bedded hollow. All sills in either stone or brick walls should be bedded at the ends only, and the centre part left hollow until the walls are thoroughly set and settled; otherwise, as the piers go down, the part between them, not being so much weighted, will refuse to set or settle equally with them, and will force up the centre of sill and break it. Where there are lintels across openings in one piece, with central mullion, the lintel should either be jointed on the mullion, or else the mullion bedded in putty at the top. Otherwise, the lintel will break; or, if it be very strong, the mullion will split; for, as the piers set or settle, the lintel tends to go down with them, and, meeting the mullion, must either force it down, or else break it, or break itself.

Slip-joints. Walls of uneven height, even where of the same material, should be connected to each other by means of a slip-joint, so as to provide for the uneven shrinkage. Slip-joints must be so designed that while they allow independent vertical movement to each part, neither can separate from the other in any other direction. Figures 71 to 73 give a few examples.

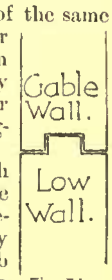


Fig. 71.

Figure 71 shows the plan of a gable-wall connected with a lower wall, by means of a slip-joint. Figure 72 shows the corner of a front stonewall connected similarly with side-wall of brick. Figure 73 the corner of a tower or chimney connected with a lower wall. The joint must be built plumb from top to bottom. Where the higher wall sets over the tongue above lower wall, one or two inches must be left hollow over the tongue, to allow for settlement or shrinkage of the higher wall and to prevent its resting on the tongue and possibly cracking it off. Where iron anchors are used in connection with slip-joints, they should be so arranged as to allow free vertical movement.

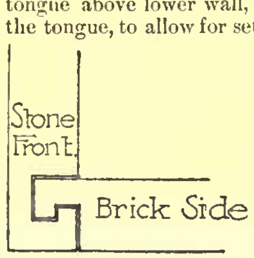


Fig. 72.

Such joints and anchors must be designed with reference to each special case. In stepped-foundations (on shelving-rock, etc.), or in walls of uneven heights where slip-joints are impracticable, the foundations or walls should be built up to each successive level and be allowed to set thoroughly before building further. A hard and quick-setting cement should be used, and the joints made as small as possible. In no case should one wall of a building be carried up much higher than the others, where slip-joints are not to be used. When building on top of old work, clean same off thoroughly or the mortar will not take hold (clinch). In summer, soak the old work thoroughly.

Old and new walls. Where new work has to be built against old work, a slip-joint should be used, if possible, or else a straight joint should be used with slip-anchors, and after the new work has thoroughly set, bond-stones can be cut in. In such cases, the foundations should be spread as much as possible, to avoid serious settlements. In all work involving old and new walls combined, the quickest and hardest-setting cements should be used. Sometimes it is advisable not to load walls until they have set, unless all walls are loaded alike, as the uneven weights on green walls are apt to crack them. All walls should be well braced, and wooden centres left in till they have set thoroughly.

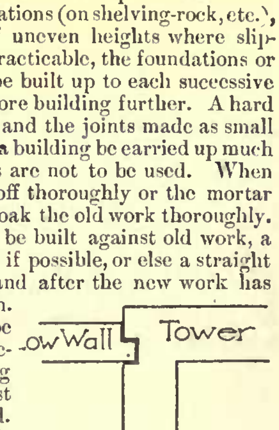


Fig. 73.

Timber in walls. Timber of any kind, in walls, should be avoided, if possible. It should only be used for temporary support, as it is liable to rot, shrink, burn out, or to absorb dampness and swell, in either case causing settlements and cracks, even if not endangering the wall. In no case bond a wall with timbers. Where it is necessary to nail into a wall, wooden plugs are sometimes driven into the joints; they are very bad, however, and liable to shake the wall in driving. Wooden strips, let in, weaken the wall just that much. Wooden nailing-blocks, though not much better, are frequently used. The block should be the full thickness of the bricks, plus the upper and lower joints. If there is any mortar over or under the block, the nailing will jar it loose and the block fall out. The best arrangement to secure nailings is to build-in porous terra-cotta blocks or bricks.

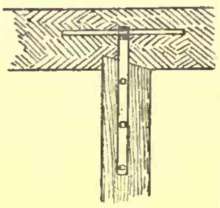


Fig. 74.

Beam ends. Where ends of beams are built into the wall, they should always be cut off to a slant, as shown in Figure 74.

The anchors should be attached to the side, so as to allow the beam to fall out in case it is burned through. If the beams were not cut to a slant, the leverage produced by their weight, when burned through, would be apt to throw the wall; as it is, each beam can fall out easily and the wall, being corbelled over the beam-opening, remains standing. It is desirable to "build-in" the ends of wooden beams as little as possible, to prevent dry-rot; if it can be arranged to circulate air around their ends, it will help preserve them. Beams should always be levelled-up with good-sized pieces of slate, and not with wood-chips, which are liable to crush. The old-fashioned way of corbelling out to receive beams, leaving the wall intact, has much to commend it. A modern practice is to corbel out one course of brick, at each ceiling-level, just sufficient to take the projection of furring-strips; this will stop draughts in case of fire, also rats and mice from ascending. All slots for pipes, etc., should be bricked up solid around the pipes for about one foot at each ceiling-level for the same purposes.

Wooden lintels. Where wooden lintels are used in walls, there should always be a relieving-arch over them, so arranged that it would stand, even if the lintel were burned out or removed; the lintel should have as little bearing as possible, and be shaved off at the ends. Figure 75 shows a wooden lintel correctly built-in. Figure 76 shows a very blundering way of building-in a wooden lintel, but one, nevertheless, frequently met with. It is obvious, however, in the latter case, that if the lintel were removed the abutment to the arch would sink and let the arch down. The relieving-arch, after it has set, should be strong enough to carry the wall, the lintel being then used for nailing only. The rule for lintels is to make their depth about one-tenth of the span.

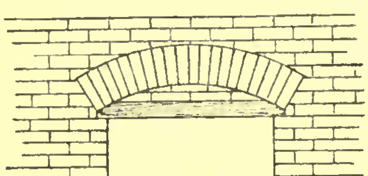


Fig. 75.

Bonded arches best. Arches are built of "row-locks" (that is, "headers,") or of "stretchers," or a combination of both, according to design. The strongest arch, however, is one which has a combination of both headers and stretchers; that is, one which is bonded on the face, and also bonded into the backing. Straight arches and arches built in circular walls should always be bonded into the backing, or if the design does not allow of this, they should be anchored back. "Straight" arches should be built with a slight "camber" up towards the centre, to allow for settlement and to satisfy the eye. About one-eighth inch rise at the centre for each foot of span is sufficient. Straight arches should never be built, as shown in Figure 77, and known as the French or Dutch arch, as there is absolutely no strength to them. Fireplaces are frequently arched over in this way, but the practice is a very bad one.

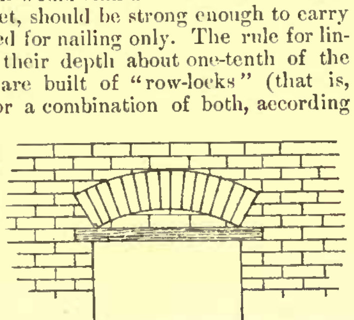


Fig. 76.

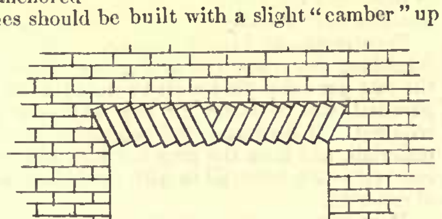


Fig. 77.

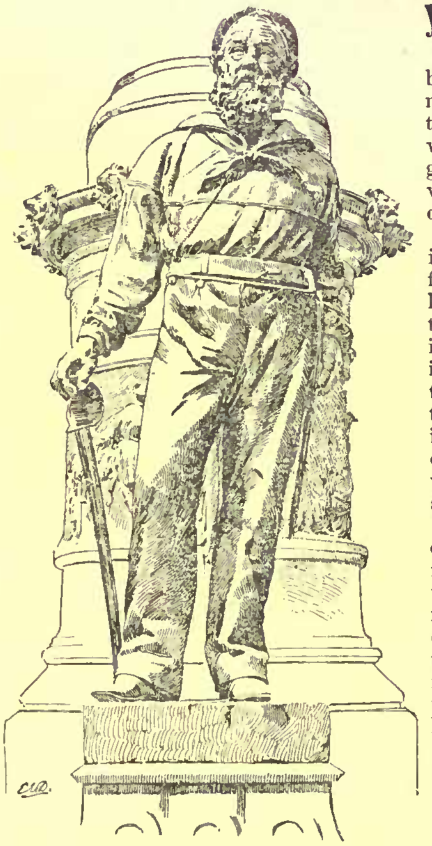
LOUIS DECOPPET BERG.

[To be continued.]

THE STATUE OF RAMESES II.—The *Athenæum* wants the fallen statue of Rameses II floated off the banks of the Nile at high water, and towed to Malta, where "any 100-ton gun-ship could bring it to London." It was once presented to England. It is agreed that to re-erect it would expose it to vandalism, and to place it at the Boulaq Museum would insure its destruction by damp. (!)

UNITED STATES GOVERNMENT BUILDING PRACTICE.[1]—IV.

FOUNDATIONS.



THE foundation for a wall is the spreading out of a wall, or the base of masonry or other material, widened so that the weight of the wall will be distributed over a greater area than if the wall rested immediately on the ground.

In preparing the drawing for foundations, the first thing to consider is how much, if any, additional width to the wall is required; in determining this, it is necessary to obtain the weight of the wall and the weight it will have to carry, and opposed to the above the weight the soil will bear safely.

To obtain the weight of the wall, the actual number of cubic feet in the wall per lineal foot is multiplied by one hundred and twelve pounds, the weight of a cubic foot of brickwork; this will give the weight per lineal foot of wall; if the wall is faced with stone, the number of cubic feet of stone in a lineal foot of the wall must be multiplied by the weight of the stone (which varies from 150 pounds per cubic foot for sandstone, to 165 and 170 pounds for limestone, marble and granite); this, added to the weight of the brickwork, will give the weight per lineal foot of wall.

The walls must carry the weight of the floors, ceilings, girders, roofs, trusses, etc.

The average weight on the floors is estimated at one hundred pounds per square foot, and the weight of the floor itself at twenty-five pounds per square foot, making a total of one hundred and twenty-five pounds for each floor. A ceiling is estimated at about one-third or one-half of the total weight of the floor. All floor and ceiling beams will transfer the weight of the floor on one-half of their span multiplied by the distance apart of beams, on centres, to the walls on which they rest. Where girders and trimmers occur, their weights and the weights they carry must be specially estimated.

The average weight estimated for deck-roofs is fifty pounds per square foot, and for pitch-roofs from sixty to seventy pounds per square foot of horizontal area; this includes the weight of the roof itself, snow and wind-pressure. Where trusses are required, one-half of the total weight of the truss and the weight it carries, is transferred to the wall at each end, and must be especially estimated.

The total weight of the wall and all the weight bearing on it, floors, roof, trusses, etc., will give the weight per lineal foot to be sustained by the foundation.

The entire weight resting on piers must be estimated in the same general manner for all walls, girders, floors, roofs, etc., resting on them.

The above weights are only used as general averages in calculating for foundations, the actual floor and roof construction must be calculated much more accurately and carefully.

To sustain the loads as above calculated, an ordinarily good soil is estimated to bear safely two and one-half tons per square foot, and a prairie or bottom soil from one to one and one-half tons per square foot.

Foundations are almost always made of concrete, but sometimes of brick or stone; they project not more than eighteen inches beyond the face of the wall on each side. When a greater projection may be necessary in order to obtain the requisite bearing-surface, it is generally deemed advisable to use piles for strengthening the foundation soil, and not more than six tons is assumed as the safe load on each pile; of course the weight the soil will sustain is considered in estimating the loads on the piles. On top of the piles or timber capping, a concrete foundation is placed, which usually projects about one foot on each side of wall, and has a depth of from eighteen inches to two feet.

Where piling is not required, after the width of the foundation has been determined so as to distribute the weight according to the capacity of the soil, the depth of the foundation is obtained as follows: Let A–C be the width of the concrete and top line of foundation; from B, the intersection of face of wall with foundation, draw

[1] Continued from page 163, No. 588.

B–D, forming an angle of sixty degrees with A–C; where this line intersects perpendicular from A at D will be the required depth of foundation.

It has been the custom until recently to take the safe angle of fracture (A B D in Fig. 1) at not less than forty-five degrees, and no defects nor unsatisfactory results have been observed in any foundations thus constructed, but as it is the endeavor of the Government to construct its buildings upon an absolutely safe basis; so as to create no reasonable doubt of safety, it has been thought best by the Civil Engineer to increase this angle to sixty degrees.

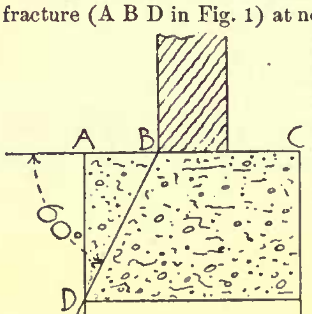


Fig 1.

The principle of equalizing the weights so that there will be the same pressure per square foot for all the foundations, is undoubtedly the safest plan to adopt on very bad soils, but the sites for Government buildings have generally been so good that this has not been considered. This principle, though the best is not absolutely reliable, as the soil at one end of a large building may safely bear two and one-half tons, while at the other end it may be insufficient for one ton of pressure. To guard against this, it is generally thought best to make the concrete mass so thick as to run no risk of cracking under a heavy unequal pressure.

Solid-Rock Foundation. — Solid-rock foundation has seldom been met with in Government building. For the building at Nashville, Tenn., it was necessary to make excavation in the rock to get basement room, and the walls were started from the rock. For the building now being erected at Rochester, N. Y., the trenches were excavated to solid rock and concrete used to fill in all the irregularities of the rock-bed and bring the foundations up to one level.

Brick Foundations. — Brick foundations are seldom used, except for dwarf walls for steps and areas, or for small partition-walls having little weight on them; a bed of cement mortar one or two inches thick is levelled up for the wall and the footings formed by offsetting each course one-and-one-half or two inches beyond the face of the course above, with a double course at bottom, as shown in Figure 2.

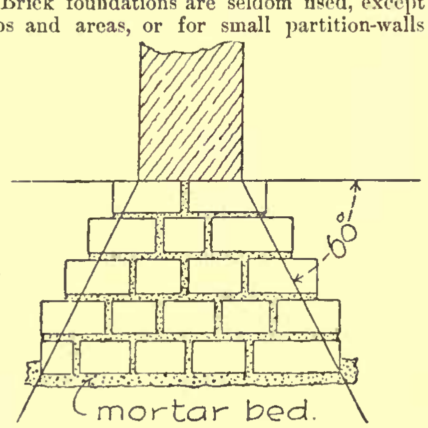


Fig 2.

Stone Foundations. — Where stone foundations are used, the stones are bedded on a level base of concrete from six to twelve inches deep, and the courses of stone foundations made not less than six inches in height; the stones should be through-stones extending through the entire width of the course in one piece; the weights which the stone footings will carry may be estimated as though the stone were an inverted beam supported in the centre, and loaded uniformly throughout its entire length.

Where the stones are not through-stones, but have joints in their widths, the angle of fracture may be taken at forty-five degrees or even less, depending upon the thickness and jointing (see Fig. 3). The beds, builds and joints to be dressed to a smooth, even, regular surface, with no holes or cavities, so that a uniform bearing may be secured over the entire bearing surface; it is unnecessary to dress the ends of stones or the tops where they do not come in contact with the upper foundation-stones or brickwork.

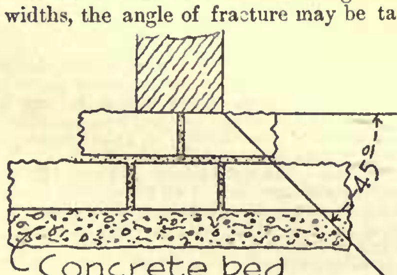


Fig. 3.

The mortar for both stone and brick foundations to be composed of good hydraulic cement and clean sharp sand in the proportions of two (2) parts of sand to one (1) part of cement measured dry.

Brick and stone foundations are measured the same as ordinary brick and stone work; the brick is estimated at a rate per M. and the stone at a rate per cubic foot; this will be thoroughly explained under the headings of brick and stone work respectively.

Concrete Foundations. — As before stated, foundations for Government buildings are almost invariably made of concrete. The materials are generally purchased under advertisement and the mixing and laying performed by days' labor under the direction of the superintendent of construction. The concrete is composed of cement, sand, and broken stone.

The bids for each kind of material are to be made at a rate per unit of quantity, and are considered separately. The quantities given in the specification are estimated; the right to purchase more or less of the materials at the quoted rates is reserved.

Cement. — The cement is to be delivered in barrels of three hundred pounds each, to be American cement freshly ground and equal in quality to the United States Government brand, manufactured by the Standard Cement Co., of Hartford, Conn. The above standard has not been long established, and is not rigidly used in all cases, as several other cements are cheaper and good enough for the purposes required. The following cements, with the given average tensile strength per square inch after immersion six days in water, have been used in the past year:

AVERAGE TENSILE STRENGTH PER SQUARE INCH.

Milwaukee cement, 45 pounds.	Rosendale cement, 53 pounds.
Newark " 40 "	James River, Va., cement, 75 pounds.
Buffalo and Akron, O., cement, 54 lbs.	U. S. G. brand, Hartford, 8 days immersion, 230 pounds; 1 day immersion, 105 pounds.
Star and Black Diamond, Louisville, 116 pounds.	

The more finely-ground cements, when mixed with sand, will stand a higher test than the coarsely ground, but the coarser cements stand the higher tests when pure and without sand.

Sand. — The sand to be sharp, clean, and free from all clay, earthy, vegetable or other foreign substance.

Broken Stone. — The stones to be hard, durable, clean and broken to a size that will pass through a two-inch diameter ring, and be in quality, shape and size suitable for concrete. Pebbles or smooth stones are seldom used, as the cement more strongly adheres to the rough or broken stones.

Mixing. — The concrete to be composed of five (5) parts of broken stone, one and one half (1½) parts of sand, and one (1) part of cement measured dry. Only the requisite quantity of water to be used (about twenty-three gallons to the cubic yard of concrete), and the whole to be thoroughly incorporated when prepared for the trenches.

Only so much mortar should be worked up at a time as can be put in the trenches and rammed solid in position, complete before the setting has taken place. The cement and sand must be well and thoroughly mixed dry, then water added and worked in until the whole is reduced to mortar of a uniform consistency. The broken stone, well drenched and drained, is then to be thrown into the boxes containing the freshly-made mortar, and worked into it until each stone is thoroughly coated with mortar, care to be taken that no more mortar is used than is necessary to fill the interstices between the stones.

Laying. — The concrete foundation is to be of the dimensions shown and noted on the drawing, of the various widths and depths figured and shown by sections, and must be carefully laid to the lines shown on the plan.

The concrete is to be mixed in small batches, and, immediately after mixing, to be put into the trenches in layers about nine inches thick, commencing and working both ways, and thoroughly but gently ramming until the water forms on the surface; this packing is to bed the broken stones firmly in contact with one another. Care should be taken that all joining of the concrete be made in the most judicious manner, the layers breaking joint. The first layer, after setting, is to be brushed and wet before the upper layer is put in, and the surface of the top layer to be finished with a skim-coat of mortar without stone, made level and even, ready to receive the masonry.

The concrete must not be thrown into the trenches from a height, as is commonly recommended, because this has a tendency to disarrange the mixing, making the stones and heavy pieces go to the bottom, but must be deposited in the trenches as carefully as practicable, so that the entire mass after deposit is thoroughly and uniformly mixed. The entire concrete foundations when completed, must be a thoroughly consolidated mass, without crack or flaw.

The opening for the passage of the drain-pipes under the walls of the building is to be formed while the concrete is being laid. For this purpose a glazed earthenware pipe, amply large for the passage of pipes, is put down, extending through the entire width of concrete, which is to be thoroughly packed around and over the top of the pipe.

Furnishing and Laying Concrete. — Where bids are received for furnishing materials and laying the concrete foundations complete, the rate per cubic yard must be stated in the proposal, at which rate payment will be made for any additional concrete that may be required. If necessary, the contractor must furnish the necessary materials, and form the trenches with plank sheeting, and after the concrete is set, must fill in with earth, and pack solid to line of top of concrete.

Measurement. — Concrete foundations are estimated by the cubic yard. The actual net cubic contents to be measured, but no deduction is made for passage of pipes; each different width and depth to be measured separately, and not in the aggregate by taking an average depth. The constants used for estimating the quantities of materials and the cost per cubic yard of concrete are:

Broken stone, 5 parts = 1 cubic yard.
Sand, 1½ parts = .33 cubic yards.
Cement, 1 part = 1.4 barrels.
Water = 23 gallons.
Labor = .375 × mason's wages per day.

By actual experiment, it is found that two-inch broken stones gently rammed, contain forty per cent of voids. This can be tested by filling a water-tight box with stones, first drenched and drained, then pouring in water, and afterwards measuring the water. This

forty per cent of voids must be filled with sand and cement, and some excess must be allowed for the absorption of cement by the stone, which will be more or less according to the porosity of the stone, and on this account a porous stone may be better for some purposes (as the cement will take a better hold of it) than a harder one, provided it has the necessary crushing strength. The constants given were adopted after careful experiments and calculations, and are believed to be the best for almost all purposes.

To estimate the cost of a cubic yard of concrete by the above constants, add to the cost of one cubic yard of broken stone the cost of thirty-three per cent (.33) of a cube yard of sand, one and four-tenths (1.4) barrels of cement, and thirty-seven and one-half per cent (.375) of mason's wages per day; water is usually considered free, and need not be considered unless it costs the contractor something to furnish it.

Cost.—The cost of cement can usually be obtained from the quoted market rates, which, of course, vary in different localities. The cheapest cement ever used by the Government was the Syracuse cement at forty-nine and one-half cents per barrel; the average cost of the other cements was from one dollar to one dollar and a quarter, except the Louisville and United States Government cements, which cost from one dollar and ninety-five cents to two dollars and ten cents per barrel. The cost of sand varies a good deal: the prices paid for it per cubic yard in the last few years were, at

Des Moines, Ia.	$ .40	Terre Haute, Ind.	$ .55
Pensacola, Fla.	.80	Syracuse, N. Y.	.98
Pittsburgh, Pa.	1.00	Columbus, O.	1.49
Galveston, Tex.	1.60	Quincy, Ill.	.80
Richmond, Va.	.95	Aberdeen, Miss.	1.00
New Albany, Ind.	1.20		

The cost of broken stone per cube yard varies greatly, as follows:

Frankfort, Ky.	$ .94	Minneapolis, Minn.	$1.95
Detroit, Mich.	2.85	Syracuse, N. Y.	1.68
Pensacola, Fla.	5.00	New Albany, Ind.	1.82½
Galveston, Tex	3.50	Aberdeen, Miss.	5.00

The cost per cubic yard for concrete materials furnished and laid complete was as follows:

Minneapolis, Minn.	$6.00	Hannibal, Mo.	$3.50
Brooklyn, N. Y.	6.50	Fort Wayne, Ind.	6.50
Pittsburgh, Pa.	4.95	St. Joseph, Mo.	4.00
Louisville, Ky.	3.50	Erie, Pa.	6.54
Leavenworth, Kan.	2.75	Rochester, N. Y.	4.00

JAS. E. BLACKWELL.

[To be continued.]

COMMUNICATIONS

CINCINNATI'S CENTENNIAL EXHIBITION.

CINCINNATI, O., April 20, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—The Exposition Commissioners have invited seven architects to submit sketches in design for the temporary buildings for the use of the Centennial Exposition of 1888. The main building will be erected in Washington Park, and will cover an area of about 75,000 square feet. The other building will be over the canal and will be about 1,300 feet long, and average 300 feet wide; the idea of the commissioners is that of something artistic, but, at the same time, of a temporary character. Each invited architect is to be paid for his design, and the successful architect will be employed with the usual architectural powers.

The new building law has just gone into effect here, and Mr. Walter R. Forbush has been appointed by Mayor Smith as building inspector. He will have an office in the city building, will have three assistants, and his salary is put at $2,500.

Cincinnati is at last to have a new City Hall, to cost about $600,000. It will be built on property now owned by the city, fronting on Plum, Eighth and Ninth Streets, and in front of the present old buildings. The commissioners appointed by the Governor are James M. Glenn, Thos. B. Paxton and Wm. B. Smith. C.

WRITTEN WORDS MORE PRECISE THAN NUMERALS.

CLEVELAND, O., April 26, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—Is there any rule governing competitions for work among contractors?

What would be the proper course to pursue with reference to a bid received where in writing it signifies a certain amount and in figures an amount one hundred dollars in excess; also, when the largest amount specified in bid is still the lowest bid received?

Please answer, and oblige one who seeks to do justice to all parties concerned. Yours truly, X.

[THE written one is generally considered by the courts to be the one which should be taken, in preference to one expressed in figures.—EDS. AMERICAN ARCHITECT.]

BLUE-PRINT SPECIFICATIONS.

LANSING, MICH., April 30, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—Enclosed please find a sheet of specifications copied by the "blue process." The original was written with Higgins's liquid India ink on Keuffel & Esser's parchment tracing-paper. Eight sheets may be printed at one exposure in a 24 x 36 inch frame. I find it both convenient and profitable. Perhaps this method of reproducing specifications has not been tried by architects who write their specifications; and while it would not meet with the approval of these who are able to dictate to short-hand writers and have specifications printed, it might prove of value to those who are less fortunate. If you think it desirable, mention of the same in your valuable journal would be appreciated. Yours very truly,

WM. P. APPLEYARD.

TRADE SURVEYS

INDUSTRIAL and trade conditions throughout the country continue favorable. Manufacturers, with scarcely an exception, are as busy now as at any time since the opening of the year. In several industries, preparations are being made for a temporary decrease in output, while in others, the production will be increased, because of the demand which is growing for future requirements. The textile manufacturers are preparing to slightly check the output, and the iron and steel makers are running to full capacity to meet orders on hand—and to accumulate a little stock if possible.

The hardware interests are crowded with orders for builders' hardware, and for all standard and special lines of goods. The margins for hardware are said to be somewhat better.

Building material of all kinds is very active. The brick-makers in all sections of the country are sold up for the season. The makers of brick-machinery are quite busy on orders, which fact indicates that it is the intention of brick-makers to extend their capacity for 1888.

The boom in real estate through the South and West, and which has extended partially throughout the East, has been accepted as a safe indication to manufacturers of all kinds of material and products that it is safe to increase their capacity and to accumulate stocks as soon as it is found in their power to do so. These are some of the favorable indications at the present writing. A few of the unfavorable ones, if they may be so termed, are, the possibly deficient supply of currency to transact the business of the country, these features having been mentioned within a few days. The securities of twelve companies which have recently listed their stock on the New York Exchange amount to $100,000,000. Then again, an incalculable sum (so it is put), has been devoted to speculative purposes in all parts of the country; next, an enormous amount of capital—roughly estimated at from two to three hundred million dollars—is being flung into railway enterprises Following this is the immense amount of money being invested in building operations of all kinds, large and small; besides, money is finding investment in a number of channels which it is impossible to define or enumerate; but the result is, that an enormous volume of capital is being diverted into reproductive channels. At this, a great many writers and supposed thinkers hold up their hands and cry, Halt! and predict ominously that disastrous consequences will follow to the railroad, manufacturing, and general industrial interests. But this is to be questioned. The United States is a phenomenal country, and we are now having a phenomenal experience. The requirements of the country are expanding rapidly, and our producing-capacity is as certainly keeping pace. There is, as yet, no over-production, and it is a question whether legitimate over-production is possible. Railroad building, thus far, has been wise and safe, unless we except a little unwise paralleling of roads in the Northwest. It is predicted by shrewd railroad-managers that there will be a recurrence in the Northwest of the experience which railroad builders had ten to twenty years ago, on this side of the Mississippi River, and notably on the roads running from New York to Chicago. Be this as it may, a break-down in the earning power of the railroads of the Northwest, will be but a small matter as compared to the general interests of the country at large.

The architects are everywhere busy. Our reports for the past week or ten days show an improving tone. An immense amount of new work has been recently undertaken consisting largely of bank, warehouse, railroad, and manufacturing work. A great deal of new work is being undertaken in the West and Northwest. That region is offering special inducements to architectural and engineering talent, and more or less of it is drifting in that direction and finding a welcome and remunerative employment. Railroad building throughout that region is not likely to be arrested, as the work is being done for future rather than present requirements.

Everything is prosperous at Chicago. The wholesalers are busy. Manufacturing interests are well supplied with orders, and all the smaller manufacturing towns throughout Illinois, Iowa, Missouri, and throughout the Southwest are reporting increased activity. Missouri is gaining in building activity, and the growing railroad and mining requirements of the Southwest promise to stimulate business operations in that State.

The returns from interior towns of from 5,000 to 20,000 population, especially in the Ohio and Mississippi Valleys, show that house and shop building will be very heavy all through the season. Private capital is seizing opportunities for safe investments. Lumber from the Northwest has been exhibiting some evidences of weakness in two or three Atlantic markets, but it is likely due to the anxiety of Eastern dealers to realize. The fears are expressed that after all the supply of building lumber will be such as to depress prices. Shipments of white pine have fallen off. Eastern distribution is only moderate, taking all markets into account. Yellow pine receipts are not beyond actual demands. There is particular activity in the hardwoods, and manufacturers are taking the hint to hasten on supplies. Freight-rate adjustments are gradually restoring confidence among the short-haul railroad patrons. The managers of mills and factories in some localities have suspended work and have placed the blame on lost business through inequitable rates. The industrial managers have no well-defined convictions as to the future course of trade. Some pretend to recognize the necessity of greater conservatism, but conservation is a mere sentiment when customers are writing and telegraphing and telephoning for the promptest execution of orders. The rush for material, merchandise, and products of labor of every description is altogether legitimate, and under wise control this phenomenal activity can be prolonged.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, by TICKNOR & COMPANY, Boston, Mass. No. 594.

MAY 14, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

WE suppose we should be considered Vandals if we ventured to say that most houses in the country had too many trees around them, but that is certainly our opinion; and when we hear people talk, as they often do, about a tree being "a living being to them," with other sentimental expressions, we are tolerably sure that the dwelling of these people is one productive of rheumatism, nervousness and catarrhs. The rule that we are inclined to favor is that the least allowable distance of any tree from a house should be twice its own height when full-grown. Even then the tree, if it stands to the southward of the house, will just cast a shadow on it at noon in winter, and we cannot see any sunshine excluded from a house in winter without regret. Mr. Charles Roberts has recently written for the London *Lancet* an article on "Trees from a Sanitary Point of View," which is commented upon by the *Builder*, in which some curious particulars are given in regard to the influence of trees upon neighboring dwellings. Mr. Roberts says that the distance of any tree from a house should not be less than the height of the tree, which we think is much too near; but he also says that trees, even at a considerable distance, materially lower the temperature of a house. This effect is partly due to the shadow, which prevents the walls and ground from being heated by the sun, but something is probably to be attributed also to the evaporation from the foliage. However that may be, a clearing surrounded by trees is usually three or four degrees colder than open ground beyond, and, of course, far more damp. In fact, many trees, when in full growth, draw so much moisture from the earth as to keep the ground about their roots almost in the condition of a wet sponge, while the obstruction which their branches and leaves present to the circulation of air greatly increases the dampness near them. We do not know whether any experiments with hygrometers in wooded districts, as compared with open country, have ever been described, but they would be of great value, as would also be an inquiry into the connection of moisture or dryness of the atmosphere with the development and propagation of diseases. Almost nothing is known on this subject, but all remember that unpleasant smells are carried much farther by a moist air than a dry one, and certain experiments seem to indicate that infectious particles retain their vitality longer in such an atmosphere, but no systematic investigation of the matter, so far as we know, has ever been made.

THE *Sanitary News* gives an account of the way in which a certain town in Wisconsin saves itself from the annoyance of having to pay its debts, which we commend to individuals in a similar condition of mind. It seems that not long ago the town issued bonds in aid of the construction of a certain railroad. The railroad never was built, but the bonds were issued just the same, and sold to innocent persons, and the proceeds spent. Now the innocent holders would like to have the interest on their bonds paid, if not the principal, and show a certain disposition to collect their coupons by levying on the town property. As this would be inconvenient, and the citizens have other uses for their money than paying coupons to the bloated widows and orphans who bought their bonds, they have devised a little expedient for, so to speak, amputating the head of the body corporate, so that when the sheriff comes with his writ there is no one on whom to serve it. As the town taxes have to be assessed, and the appropriations made for municipal purposes, it is necessary for a brief period to have city officials. These are regularly elected every year, but immediately after the election the new mayor and aldermen meet in a room with barricaded doors, and vote all the taxes and appropriations for the year. As soon as this is done, and before the sheriff has had time to break down the doors and get at them, they all resign, leaving the city for the remainder of the year without any official representative on whom a writ can be served.

A NEW blasting-cartridge, for use in mines, has been invented by M. Kosmann, of Breslau, which, although its inventor expects wonders from it, appears to the ordinary mind to present some doubtful points. The explosive, or rather, the expansive agent employed is hydrogen, which is liberated by chemical action in the cartridge. This is composed of a glass tube, contracted near the middle and also at the end, so as almost to close it. In the larger division, which is at the sealed end of the tube, is put a mixture of equal parts of crude sulphuric acid and water; and a cork is inserted in the opening by which the two portions of the tube communicate. Before charging the drill-hole, the workman plasters it around with clay, and then primes the cartridge by filling the smaller cavity with the spongy refuse zinc collected from the refineries. A little iron rod is placed in the zinc, with the end projecting through the mouth of the tube, and the cartridge is then inserted in the drill-hole, and the mouth closed with clay, the end of the rod only projecting outside. To fire the blast, the workman strikes the end of the rod, driving it in, and either pushing out the cork in the partition between the acid and the zinc, or breaking the tube, so that in either case the acid and the metal are brought in contact, and hydrogen is generated by the decomposition of the water. The rod is made conical, with the large end inward, so that the expansion of the gas forces it tightly into the opening, and the inventor calculates that the pressure exercised upon the walls of the drill-hole will amount to more than five hundred thousand pounds to the square inch, so that the hardest rock can be torn apart with certainty; yet the action will be so slow that the workman can easily escape after firing the charge. The *Revue Industrielle* says that the practical efficiency of this new cartridge has not yet been proved, and we may be allowed to doubt whether it ever will be. Of all known substances, hydrogen is the hardest to keep in captivity. Even under the pressure of the atmosphere it escapes freely through India-rubber or cork, and is said to pass slowly through most metals; and that M. Kosmann can confine it for any length of time, under a tension of half a million pounds to the square inch, by barriers of rock and clay, seems to us decidedly improbable. Even, however, if he should be able to do so, and to burst rocks in that way, the result of the operation would not be altogether satisfactory. According to the inventor, one of his cartridges, on being fired, produces about one hundred and twenty cubic feet of hydrogen, which, if the blast succeeds, is set free in the gallery of the mine. This quantity of hydrogen, meeting the air of the mine, would mix with three or four times its own volume to make at least five hundred cubic feet of a terribly explosive gas, essentially the same as the fire-damp of a coal-mine, but far more explosive and dangerous, and no more work could be done until this had cleared away. The employment of a single cartridge in a gallery of ordinary size would charge this with an explosive mixture for something like a hundred feet from the heading, and, unless artificial ventilation were used, it would be many hours, in rock of a compact sort, before it would pass away.

THE Houses of Parliament, or, as we suppose it should be called, Westminster Palace, in London, has suffered for many years from bad drainage. The building stands on the very edge of the Thames, and the basement floor is nearly at the level of the main sewer, so that after a heavy rain, which occurs very often, the great drain of the Palace is choked, and stands full of sewage until the water subsides, when the greater portion runs out, although a certain quantity, filling the drain from one and one-half to two feet deep, always remains nearly stagnant in it. The drain, being of brick, is very pervious to sulphuretted hydrogen and the other unpleasant constituents of sewer air, to say nothing of the bubbles of unfiltered gas which escape through seams and unvented traps, and for a long time the atmosphere of the building has been getting more and more foul. Legislators, having their minds intent on more important affairs, do not pay much attention to smells, but not long ago the stench from the drains was so overpowering in the House of Commons that the House was compelled to adjourn: and, as a day's work of the Imperial Parliament of Great Britain is a serious thing to lose, the Commons, at their next session, appointed a committee to see if the smells could not be abated. The chairman of the committee was a very distinguished chemist, Sir Henry Roscoe, and a well-known and able London architect, Mr. L. H. Isaacs, who is a member of Parliament, was also appointed on it. It is hardly necessary to say that there are few domestic smells which an architect and a chemist could not investigate with success, and Mr. Isaacs did his part of the work thoroughly. He crawled twice through the drain, at the risk, we should say, of his valuable life, and made notes of its condition, which he laid before the committee. The engineer who had originally planned the drainage scheme was then called in, and with his help a new arrangement was devised, which has since been carried into execution.

THE main peculiarity of the new plan is that the drain as now laid discharges independently of the city sewer, and its outfall is, moreover, about twenty feet higher than the inlet. That the outfall must be higher than the inlet was a foregone conclusion. When the Palace was built, it was believed that rivers were especially designed by Providence for receiving drainage; and the Palace drain simply went by the shortest course from the basement to the river wall, where it emptied its contents into the stream. After the passage of the Rivers Pollution Act, and the commencement of the vast works intended to keep the sewage of London out of the Thames, the Parliament-House drainage could no longer be suffered to flow into the river, and the course of the conduit was modified so as to secure an outfall into the great Metropolitan low-level intercepting-sewer. This intercepting-sewer, being unavoidably at about the same level as the drain from the building, backed up water into it whenever the sewers ran full, and the ordinary flow of the intercepting-sewer maintained a certain depth of water in the drain at all times except when it was purposely shut off and pumped dry. The drain being a huge brick tunnel, ten and one-half feet high and three feet wide, which, after heavy showers, was filled nearly to the top, the pumping was a serious operation, and as soon as it was over, the sewage began to accumulate again in the bottom of the conduit. The first step in modifying all this was to deduct about ninety-seven per cent from the capacity of the main drain by the simple process of building it up with concrete, and laying a twelve-inch iron pipe along the bottom. This pipe is ample for carrying off all the rainwater which falls on the roofs and courts, besides all the drainage of the building, and it is hardly necessary to say that it is far more easily kept clean than a larger conduit could be. The twelve-inch pipe leads to a row of Shone's ejectors, which are tanks in which air under pressure is admitted intermittently over the surface of the liquid contained in the tanks, forcing it out into a discharge-pipe, as the steam does in a pulsometer pump, and, in the pauses, allowing the tanks to fill from the inlet-pipe. The compressed air for operating the ejectors is obtained from a set of four gas-engines, of four horse-power each, which are placed in the basement of the Palace, six hundred and fifty feet from the ejectors, and transmit the compressed air through small pipes. With the average flow of water through the drain in dry weather, the tanks fill in ten or fifteen minutes, and half-a-minute is sufficient to force their contents all out into the discharge-pipe, which empties into the city sewers at a much higher level. Ordinarily, even in such rain storms as occur in London, one gas-engine and one ejector will move all the sewage rapidly to the outfall, but in cases of storms or floods, the others are ready to quadruple the capacity of the apparatus at a moment's notice; and to be sure that notice is given, an electric signal rings in the engine-room whenever the sewage comes into the ejector-tanks faster than it is carried off. It is to be hoped that our great public buildings may always be built on higher ground than the damp, low Parliament-Houses, but there are some situations, such, for instance, as New Orleans, where sewage must either be carried above ground in order to get any flow to the outfall, or must be lifted by some such apparatus as the ejectors used in this case.

MOST of our readers probably take some intelligent interest in photography and the allied arts, particularly those which concern themselves with the reproduction of photographic images by the printing-press. Among the innumerable processes devised for this purpose, none, to our mind, has yet equalled that employed by Mr. Ives, of Philadelphia, and most persons who see the results of his work are anxious to know how they are accomplished. As every one knows, the basis of all the modern processes for making photographic-relief plates suitable for use in the printing-press, consists in the translation, so to speak, of the soft, smooth gradations of an ordinary photographic image into one formed of black dots or lines, the dots or lines being larger and thicker in the deep shadows, and disappearing almost entirely in the lights. By impressing an image so transformed upon the metal plate, it is possible to obtain, by treating with acid, the dots in relief, and to impress them as dots on paper, producing a picture like a fine wood-engraving. The conversion of the ordinary photographic image into one formed of dots is usually effected either by taking a negative with a wire netting interposed between the object and the sensitive plate, or by using a fine silk gauze under the negative in printing upon the prepared relief plates; but there are other methods, more or less successful, also in use. The Ives process, although it arrives at the same result, differs considerably in the detail. Instead of photographing a printing through a netting of any kind, the negative is taken in the usual way, and printed on a plate covered with gelatine, in which bichromate of potash has been dissolved. The well-known effect of light upon "bichromatized" gelatine is to render it less soluble in water, and when, after a sufficient exposure to the sun, the gelatine film is soaked in cold water, the portions which have been shaded by the opaque parts of the negative absorb water and swell, while those which have been hardened by the sunlight remain unchanged, and those corresponding to the half-lights of the negative swell, but not so much as those which have been wholly shaded. After sufficient soaking, the film is taken from the water, and a plaster cast is made from it. This, of course, presents all the irregularities of surface of the gelatine in reverse. The portions of the gelatine shaded by the opaque parts of the negative, which correspond to the bright parts of the object photographed, having been most swelled by the water, are represented by hollows in the plaster surface, and the dark parts of the object, which are transparent in the negative, and allow the sun to act freely through them in hardening the gelatine, and preventing it from swelling by absorption of water, are represented in the plaster as projections. The next step is to treat the white plaster plate, the reliefs and depressions of which are almost invisible to the eye, with a pad of vulcanized rubber, having minute points or lines, according to the character to be given to the prints, all over its surface. The pad is inked and applied to the plaster. On the most projecting portions of the plaster the points press so firmly as to flatten a little, and the ink which they carry is spread out, so as to cover these portions with a uniform black tint. On the less elevated parts the points only touch the plaster, producing dots of greater or less size according to the degree of pressure, and in the depressions, which correspond to the high lights of the object, the points do not touch the plaster at all When the inked pad is removed, the plaster block thus shows the picture fully rendered in black dots on the white ground. Another negative is then taken from it, which, presenting nothing but black masses and dots, variously distributed, can be used at once to produce a relief plate in the same way as a negative from a line drawing, and the contrast, which can be obtained by the use of the plaster, between the masses of unbroken black and the pure whites of the high lights, gives the prints a brilliancy which process prints are apt to lack.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — XII.

NORTHWEST SEAL ROCK.



NORTHWEST SEAL ROCK, or, as it has been re-christened St. George's Reef Light Station, is now in process of construction on a small rock forming the outermost danger of St. George's Reef, opposite Crescent City, California.

Capt. A. H. Payson, Corps of Engineers, U. S. A., is in charge of this work. The high rocky coast from the bight of Crescent City to Point St. George, four and one-half nautical miles, trends in a northerly direction, and is bordered by a belt of numerous high, rocky islets and sunken dangers, nearly a mile in width.

North of the Point the coast-line turns nearly at right angles to its previous direction and becomes low and sandy, but the direction of the obstructions remain unchanged for about six nautical miles to seaward, and make what is known as St. George's Reef.

Inside the reef, close under Point St. George, is a broad and deep channel, sometimes used during heavy northwest weather by northerly-bound steamers, but only in daylight and clear weather, and probably at some risk from sunken dangers not shown on the charts.

The position of Point St. George, about midway between Capes Mendocino and Blanco, would naturally suggest it as an appropriate place for a first-order light, did not experience at Cape Blanco, an almost similar situation, show that the headland itself would but imperfectly answer the purpose. When there is not dense fog there is usually so much haze in this climate that vessels forced by the reef to give the point a berth of ten to twelve miles, would rarely see even a first-order light upon it, while a fog-signal, six miles from the danger it is designed to mark, would be practically useless.

Northwest Seal Rock is nearly two miles outside of its nearest neighbor, Southwest Seal Rock, with a clear and deep, but unused passage between, and has close to it on all sides from one hundred and eight to one hundred and eighty feet of water, with no outlying dangers. It is a mass of metamorphic material, varying considerably in character, extremely hard to drill, and brittle under the action of explosives, but offering almost the resistance of glass to the action of the sea.

The superficial area of the rock at the water-line is about forty-six thousand square feet, and its general form is an oval with a high central ridge running nearly east and west along its longer axis, sloping gently on the north, but more steeply on the sides from its crest to the sea level. To the westward is a prolongation, called Little Black Rock. The greatest height of the ridge, fifty-four feet, is at its eastern end.

The gentle lower slopes and smooth, water-worn surfaces, were plain indications that the sea at times swept over its top. Yet, to gain the requisite area for the foundation, it was necessary to excavate at a point fully thirty feet below the crest. There was no space available on the site where even temporary security of men or material could be assured, and the frequency and quickness with which all parts of the rock became untenable, greatly exceeded any previous anticipation. It is a peculiarity of this coast that a heavy sea, which results from off-shore winds and cannot be predicted from any sign, will begin to break upon the rock; and so suddenly did this happen during the working season of 1883 that in three or four hours from a dead calm the topmost surface of the rock was swept. The general features of the site for construction upon it could hardly have been more unfavorable.

Crescent City, thirteen miles away, is the nearest point at which a landing on the coast is possible. This is a shoal and rock-encumbered bight, quite open to the south and west, but offering a somewhat disturbed shelter to be relied on from the middle of June to the following September. During the remainder of the year it is exposed at any time to the entrance of the prevailing westerly swell which breaks outside the anchorage and endangers any vessel lying in it. Crescent City is a small and isolated settlement, distant by difficult mountain roads one hundred and fifty miles from the telegraph, and more than three hundred miles from a railway. The nearest harbor is Humboldt Bay, where there is a good-sized town and frequent communication with San Francisco. The depth of water on the bar varies from fourteen to twenty feet. This often causes detention, but is not a serious obstacle. Its main drawback as a depot is its distance from the rock, but this is unavoidable.

The project for the foundation consisted of an oval outline adapted to that part of the rock which included the required area, and necessitated the cutting of four horizontal terraces for the foot of the pier-wall, and the suitable preparation of the mass of rock left standing within, for a bond with the pier filling; provision was to be made for water storage in the otherwise solid mass of the pier below the top of the rock.

[1] Continued from page 189, number 590.

Since it was impossible to leave men and material on the site, it was necessary either to take them to and from the nearest landing at Crescent City, as occasion served, or to provide floating accommodations near the rock. The saving of time, so vital to success, and other evident advantages of the latter course, were strong arguments in its favor; it was, therefore, adopted, and a top-sail schooner of one hundred and twenty-seven tons, called "*La Ninfa*" was selected. She was nearly new and strongly built for carrying copper ore on the west coast of South America, and had shown her fitness for the work by being used temporarily as a light-ship to mark the wreck of the "*Escambia*" on San Francisco bar. She was altered and in various ways specially fitted for the work. Her outfit was made as complete as the large experience of Mr. Ballantyne could suggest. He had been appointed superintendent of construction of this work, owing to his success in building the station at Tillamook Rock, a work of similar character, and, besides, many of the men who had worked there were also employed here.

The steamer "*Whitelaw*" was chartered to tow the schooner to the rock and to place the moorings. After several attempts she succeeded in doing so, arriving at the rock on the morning of April 9, 1883; she placed the big twelve thousand pound mooring and attached the schooner to it, but was then, owing to the boisterous condition of the sea, compelled to abandon the attempt to place the other moorings and stood off to sea. From then until the sixteenth a continuous gale prevailed, the schooner holding on in great discomfort and the steamer lying by in the offing, but the weather then moderated sufficiently to enable soundings to be made on the site of the remaining moorings. They disclosed the fact that the depths were greater than those shown on the coast-survey chart, so Mr. Ballantyne availed himself of the presence of the steamer and went in her to Humboldt Bay to get larger spar buoys, where he was detained until the 27th. Leaving on the evening of that day he arrived at the rock on the 28th only to find that the schooner and the big mooring-buoy had both disappeared. The weather becoming fine, the steamer laid the remaining moorings, and then cruised in the neighborhood of the rock until the 3d of May, awaiting the re-appearance of the schooner, when she again went to Humboldt Bay to communicate with Captain Payson for instructions.

On arrival there she found that the "*La Ninfa*" had been sighted during a gale off Cape Mendocino, on the 30th of April. The "*Whitelaw*" put to sea in search, and on the 6th of May fell in with the missing vessel twenty-five miles south of Crescent City. She had parted her new eight-inch hawser during a furious gale on the night of the 22d of April, and had since been blown first north and then south in a vain endeavor to keep near her work. Taking her in tow the steamer, for the second time, placed her in position on the morning of the 9th of May, and the weather being favorable a landing was at once made on the rock, ring-bolts put in, a temporary traveller rigged, and the work on the rock finally and auspiciously begun.

Arrangements were made with a small coast-steamer, making regular trips between Crescent City and San Francisco once every ten days, to visit the rock on each trip.

The southerly winds, which had so far prevailed, were almost immediately succeeded by the violent northwesters of early spring, and rock-cutting made but little progress until the early part of July. In the mean time a small donkey-engine had been put on the "*La Ninfa*" to assist in handling the numerous moorings and spring lines, and to work the traveller. A new bad-weather mooring was put down to replace the one lost, various attempts to recover it having failed.

From this time forward the work went on without material interruption. There was much parting of lines and tackle, and the men often had to be taken hastily off the rock just after they had been put on, but in spite of many narrow escapes and some dangerous accidents, there was no serious injury to any one. Work on the north low bench was the most difficult, though it was twenty-five feet above the sea; the men there were almost constantly drenched with spray, and hardly a day passed when the sea did not break upon it at high water.

During a gale on the 29th and 30th of September stones, over a ton in weight, which had been rolled overboard from this bench, were swept like chips up along its whole length and over again on the east end. On September 10, while two quarrymen were drilling a hole on the lee side, just below the top of the rock, a tremendous sea swept completely over it, washing them down the steep south slopes nearly thirty feet, where they fortunately lodged on the south bench, none the worse save for a few bruises.

It was judged best to store the high explosives, of which there were at times six hundred pounds in stock, on the rock itself. The magazine, built of heavy timbers, was put in a square excavation, made especially for it, in the topmost pinnacle, fifty feet above the sea, and secured by a network of four-inch lines set over its top as tightly as possible to ring bolts in the rock; yet the magazine was several times twisted around by the sea under its rope lacing. The presence of this large amount of explosive in such close proximity to the blasting was a source of much apprehension, but the precaution was taken to wrap it in many thicknesses of tarred canvas and no accident occurred.

To avoid the delay of frequent and tedious changes in the position of the schooner she was hauled in close enough to the rock to permit the use of the wire traveller-cable, and kept there as long as the spring lines held. She was much exposed to flying fragments, which often went over her in showers, marring her appearance a good deal, but doing no serious damage.

The total distance over which the cage of the traveller passed was three hundred and fifty feet. The traveller-block was made of two pieces of boiler-plate, bolted together, and forming the bearings for the axles of four grooved gun-metal wheels, which just held the cable between the upper and lower pairs, and made it impossible to nip or bind, even were it twisted completely round the cable by the sea. The cage was a horizontal iron ring four feet in diameter, suspended from the traveller-block by three cords, attached at equal distances around its circumference, and having hung below it a piece of plank on which the passengers stood. At first the men were hauled to and fro singly in a breeches-buoy, but the cage was found much more convenient as it permitted the transport of at first four, and later of six men at a time, and allowed them to easily extricate themselves should any accident happen. The whole arran ement worked perfectly, and by the aid of the engine a round trip, taking off six men, and return, could be made in three minutes. The shore end of the cable being some sixty feet above the sea, and the lowest point of its curve not over fifteen feet, the cage, when released from the rock ran down this slope with great speed. Taking advantage of this, and standing by to haul in with the engine, the men were often taken on board dry, when every sea went over the low part of the cable; such confidence did they gain in this means of retreat that they did not think of leaving the work till the sea began to run continuously over all the working levels; then, lashing their tools to ring-bolts prepared for the purpose, the cage was put in use and in twenty minutes all hands would be in safety. But one accident occurred with it, and that was the parting of the traveller-rope in a heavy sea just as four men were being swung off the rock, but, luckily, they had only started, and so fell unharmed on the east bench. Whenever the sea would permit, the men were taken to and from the rock in a surf-boat to save the costly item of water and also time. It was extraordinary to see how, little by little, they became more venturesome, till, at the end, they would jump out one by one from the boat, holding to a life-line from the rock, with the sea rising and falling fully fifteen feet on the nearly vertical east face.

The schooner's position near the rock, the character and position of the moorings, and the manner in which the traveller was rigged, are shown in the accompanying plate. About the middle of August the foundation benches had been roughly formed, and needed only the finishing touches of the stone-cutters.

The position and size, eleven thousand cubic feet, of the cistern having been fixed, the party commenced to work on this; the ten days from the 18th to the 28th of September were the finest of the whole year, and the men, warned by the lateness of the season and the ominous westerly swell, and very anxious to end their long seclusion, worked with such eagerness, that, contrary to the expectations of the foreman, everything planned for the season was finished by 2 P. M., September 28. The tools were taken on board that evening with the men, and by 2 A. M. next day the long-expected first winter gale had reached such violence that all the rock-lines parted, and the schooner was lying by a single line to the outer buoy. The storm continued until the 1st of October, and on the 2d the steamer "*Crescent City*" came out to the rock with instructions for closing up the work. As it was too rough to communicate there, the schooner, at 9 A. M. on the 2d of October cut her last remaining mooring-line and followed the steamer under the lee of Point St. George, where the stone-cutters and quarrymen were taken off, and she started to make the best of her way to San Francisco, where she arrived forty-eight hours after, being favored with a strong northerly gale. The steamer did not arrive at San Francisco until three days later, when the working force was disbanded and the plant stored at the depot on Yerba Buena Island.

The sketch shows the appearance of the rock at the end of the working season.

The next year's work was dependent on the action of Congress in granting an additional appropriation, and, as it was a long session, no more money would be available until July or August; therefore, to save time, the steamer "*Whitelaw*" was sent to the rock to replace the moorings and to erect the big derrick in anticipation of the season's work; this she safely accomplished by July 2, but as Congress appropriated but $30,000, too small a sum to continue work at the site, it was devoted to the preparation of material at Humboldt Bay.

Before any work had been done at the rock it was first determined to get the necessary granite from the Sierra Nevada and to use sandstone for filling, but a rumor having reached Captain Payson that granite had been discovered on Mad River near the railroad from Humboldt, he at once examined the place and found a deposit of excellent quality, but no evidence of the existence of the rock in place. The side of the mountain showed, within perfectly defined and narrow limits to the right and left, but extending for a considerable distance with less-marked boundaries up and down the slope, the tops of what looked like water-worn boulders, some of them of apparently several hundred tons in weight.

This discovery materially diminished the cost of the work and made the delivery of the stone more certain and speedy. Enough granite was found here not only for the facing, but also for all the interior filling. It was taken from the quarry to the depot at Humbeldt to be dressed to shape.

The next year, 1885, Congress appropriated $40,000 more, which was also devoted to quarrying and dressing stone.

In 1886 there was no money appropriated.

The small appropriation of 1884–5 necessitated the abandonment of measures already taken, the waste of much money in useless preparation, and the suspension of work upon the rock.

In 1887 Congress appropriated $120,000, active preparations were at once made to commence laying the stone already prepared, and it is hoped to complete the first eight courses on the rock by the end of this working season.

The amounts so far appropriated are as follows:

August 7, 1882, . . .	$50,000.
March 3, 1883, . . .	50,000.
July 7, 1884, . . .	30,000.
March 3, 1885, . . .	40,000.
March 3, 1887, . . .	120,000.
Total, ...	$290,000.

It will take about $160,000 to finish the work: had the appropriations been of adequate sums it would now be completed, and at much less expense. In a future article I expect to finish the history of this light-house, which may fairly rank among the *sea-rock* light-houses of the world.

ON THE THEORY OF THE ABANDONMENT OF ANCIENT LIGHTS.[1]—II.

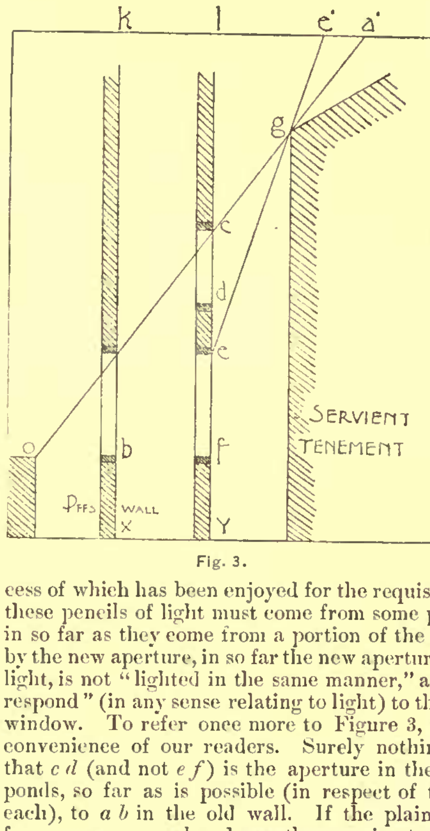


Fig. 3.

FROM these examples it surely follows that if "to abandon" means to cease to use, then the above principle, which requires the position of the new window "substantially to coincide" with that of the old one, is based on a fiction, and that the application of it must constantly produce absurd and (it is submitted) unjust results. Yet it will be observed that learned judges continue to apply it, while, almost in the same breath defining the prescriptive right as a right to a certain "cone"[2] of light, or to the enjoyment of certain specific pencils of light, the access of which has been enjoyed for the requisite number of years. But these pencils of light must come from some part of the sky area, and in so far as they come from a portion of the sky area not intercepted by the new aperture, in so far the new aperture does not enjoy the same light, is not "lighted in the same manner," and finally does not "correspond" (in any sense relating to light) to the aperture of the original window. To refer once more to Figure 3, which we reprint for the convenience of our readers. Surely nothing could be clearer than that *c d* (and not *e f*) is the aperture in the new wall which corresponds, so far as is possible (in respect of the light intercepted by each), to *a b* in the old wall. If the plaintiff's light were derived from an area equal and exactly opposite to *a b* on the surface of the wall of the servient tenement, then and then only could the aperture *e f* be said to "correspond" (in the above-mentioned sense) to the aperture *a b*; for in that case, and in that case only, would identity in position involve identity (so to speak) of light.[3]

Now, without denying that a principle based on a fiction (legal or otherwise) may sometimes be practically useful, is it not possible here to apply one which is based upon facts, and which would yet afford a sufficiently clear test of the rights attached to the dominant and servient tenements respectively?

The result of the above considerations is this, that a prescriptive right to light having been acquired in respect of the aperture *a b*, over the obscuring horizon at *g*, the owner of the servient tenement is restricted in the exercise of his *primâ facie* right to build as he pleases by two lines of limitation shown in Figure 4.

(1) Below the level of the obscuring horizon *g*, he cannot advance his building (supposing him to have on other grounds the right to advance it) beyond the line *g b*,—*g b* representing one side of the sectional volume of light,[4] *g b p* illuminating the window *a b*.

(2) Above the level of the obscuring horizon, *g*, he cannot raise his building (supposing him to have on other grounds the right to retire it, and to raise it) above the line *g a'*,—*g a'* representing (in section) one side of the inverted pyramid shown in Figure 1 A,

[1] A paper by George H. Powell, Barrister-at-law, published in the *Builder*. Continued from page 212, No. 592.

[2] See remarks of Bowen, L. J., referred to above, and *passim*.

[3] It will be observed (Fig. 3) that the aperture *c d* is smaller than the aperture *a b*. If it were not so, *c d* would, of course, intercept a *larger* area of sky than was intercepted by the original aperture, *a b*. But this would confer on the plaintiff an advantage which he would have no right to retain, and of which the defendant could at any moment, before a fresh period of prescription had elapsed, deprive him. In practice, the plaintiff would often take his chance (since the decision in Tapling *v.* Jones. q. v. *ante*) of acquiring a new right. We are here considering only the continued enjoyment of his old rights unimpaired.

[4] Shown as applied to a horizontal skylight, in Figure 1 B.

whose base represents the intercepted area of sky. He can, for instance, advance his building below the present horizon *g* (Fig. 4) to the point *n*. He can raise it above the horizon *g* to the point *m*. But he can do no more than this. And the positions of the lines of limitation *g a′* and *g b* are (it is needless to observe) always easily determined, depending as they do on the angles which *g a*, *g b* (straight lines drawn from the obscuring horizon to the top and bottom of the window respectively) make with the straight line *a b*.

The above being the restrictions imposed on the defendant in the enjoyment of his property, it only remains to add that (assigning but its ordinary common-sense meaning to the term "abandonment") whenever the plaintiff so changes the position of his window that it becomes possible for the defendant to advance or to raise his building beyond either of the aforesaid lines of limitation without interfering with the enjoyment by the plaintiff of whatever of his original prescriptive rights he still continues to enjoy, the defendant can so advance or raise his building with impunity.

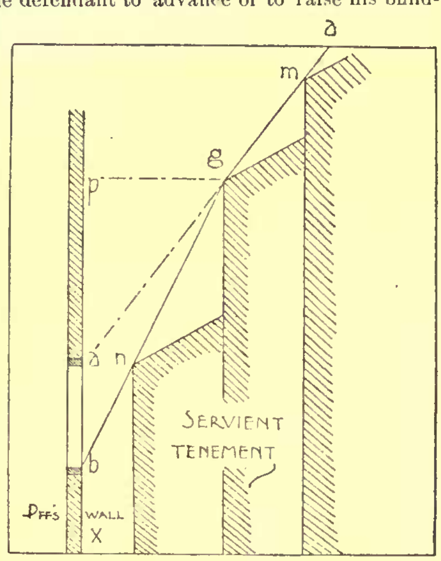


Fig. 4.

Now to return to the questions originally propounded, and to answer them on the principles above laid down.

(1) When for the original window *a b* is substituted[1] a window at *c d* (Fig. 3), here there is no abandonment, since, whether we consider the prescriptive right to be a right to the enjoyment of certain specific pencils[2] of light, or a right to intercept (in the manner shown in Fig. 1 A) a certain area of sky, the plaintiff is in either case, so far as is compatible with the change in the plane of his wall, in the same position as he was before.

The defendant's rights are similarly unaltered. He is still entitled to advance his building to any point on the line *g b*, or to raise it to any point on the line *g a′*. He cannot do more than this without obstructing the passage of light which used to fall upon the original window *a b*, and now falls upon the new window *c d;* and on what ground could he be justified in doing this?

(2) When for the original window *a b* is substituted one in the (so-called) "corresponding" position *e f*. In this case there is an abandonment of the enjoyment of all the light coming from the sectional area of sky between the points *e′* and *a′* (Fig. 3). At least all the said light (which certainly was used before) is now used no longer; for it is clear, if the sectional area *e′ a′* were the only luminous part of the whole area *k a′*, that, while a window in the position *a b* would be lighted, a window at *e f* would receive no light from the sky at all. There being, to a certain extent, an "abandonment," how far does this affect the defendant's rights?

It is surely of the essence of the theory of "abandonment" that these rights (in the case supposed) should be enlarged in so far and only in so far as those of the plaintiff's are, by his acts, shown to be "waived." *Primâ facie* if he ceases to enjoy a right he may be taken to have "waived" it. In any case the defendant cannot be deprived of his previous right to build up to any point on the line *g b*, as, for instance, to raise an obscuring horizon at the point *n* (in Fig. 4). Now it is clear that a window "in the same position" as *a b* (in the advanced wall) might be totally obstructed by an obscuring horizon at *n*. So far the plaintiff would only have incurred a loss by his own act, but the defendant gains something. Whereas he could previously raise his building (above the horizon *g*) to any point on the line *g a′;* he can now raise it to any point in the line *g e′*, since, as we have seen, the light from the area between *e′* and *a′* does not reach the plaintiff's window in its new position at *e f*, and there can be no reason why the defendant should not obstruct the passage of that which the plaintiff, through his own act, no longer enjoys, and for that very reason has no longer a right to enjoy.

(3) When, supposing *e f* to be the original window, there is substituted for it a new window in the same plane, in the position of *c d*. Here the original "line of limitation," below the obscuring horizon *g*, would be a line drawn from *f* to *g*.[3] But since the plaintiff has, by the substitution of his new window, *c d*, for the old window, *e f*, relinquished the enjoyment of all light passing below an imaginary line *g d;* there has, therefore, been an "abandonment" *pro tanto*, an "abandonment" of something affecting the defendant's rights. The latter may now advance his building to any point on the line *g d*. But he cannot do more than this without obstructing the passage of light which the plaintiff enjoyed before and is still enjoying.

But the same, or rather a larger area of sky, is intercepted by *c d* than was intercepted by *e f*. But this, as has been already explained, cannot impose any further restriction on the defendant. He has still the right to raise the servient tenement (above the horizon *g*) to any point on the line *g e′*.

(4) Still supposing *e f* to be the original window, for which a new one (in another plane) is substituted in the position *a b*. In this case the line of limitation below the obscuring horizon *g* will be advanced to *g b*, for similar reasons to those given in the last case, and (also as in the last case) the defendant may still raise his building (above the obscuring horizon) to any point on the line *g e′*.

(5) Lastly, supposing *c d* to be the original window, and a window in the same plane in the position *e f* to be substituted for it. Here there is indeed a practical abandonment. It only remains (as in the said case, *ante*) for the defendant to take advantage of this. The plaintiff has moved his window into a position where the acquired line of limitation, *d g*, is of no use to him, since the defendant, by raising his building, as he had always a right to do, to a point on the line *d g*, might totally obstruct the new window at *e f*.

This case, therefore, requires no further consideration. The plaintiff has, so to speak, advanced into the defendant's territory, and, if he loses by this step, has clearly only himself to blame.

It will be seen that of the above five propositions the greater part are directly contrary to the law as at present applied. Yet they all result from the consistent application of a perfectly simple principle, which, moreover, finds a considerable amount of support (implied if not expressed) in many judicial expositions of the law of ancient lights. The inconsistency (as it is submitted to be) in these expositions, taken as a whole, which suggests the adoption of such a principle, may be shortly summarized as follows:

It is unquestioned that, according to existing law, when the plane of a wall is advanced or retired, the prescriptive right existing in favor of a window in the old wall is held to be retained in favor (only) of a window in the new wall, substantially "in the same position" as the original window. But when we inquire why this is so, the answers are various, though all equally unsatisfactory.

In one place we are told that it is because the two windows are lighted "in the same manner." But any meaning which can be assigned to this rather loose expression involves an untruth, since both the total amount of light received[4] and its angle of incidence are in each case different. In another place, what is perhaps the same idea is expressed in more definite language. The new window, we are told, enjoys the same "cone of light" and receives "the same pencils of light." This explanation is even more openly repugnant to common sense and common observation. "The same pencils of light" (assuming the obscuring horizon to be above the level of the window), unless they follow a zig-zag course like that of a flash of lightning, could by no possibility reach the two windows, and the "cones of light" in the two cases are not even similar cones. Therefore, if the object really desired is that the window should be lighted in a similar manner, or in as nearly the same manner as possible (in respect of pencils, cones of light, and intercepted area of sky) as the original window, then to put the new window "in the same position" relatively to the wall as the old one, is to go out of our way to avoid the attainment of that result.

In fact, if the prescriptive right be a right to the enjoyment of light (as it is universally described) and not a right to the enjoyment of a window in a certain position, the present law, under the pretence of preserving the exercise of that right, in fact insists on its abandonment. The owner of the dominant tenement is constantly held to have abandoned that which he still continues to enjoy, and as often to have preserved his prescriptive right (strangely enough) by giving up the enjoyment of it. Surely such confusion in the theory of the law is not unavoidable. It has been said that a Court of Justice will not listen to elaborate mathematical calculations, and it is, no doubt, in the highest degree desirable that the rules governing the acquisition and destruction of this most important of "urban servitudes" should be clearly intelligible not only to the judicial but to the ordinary lay mind. But if a mere observation of well-known facts and obvious phenomena provides us with an intelligible test, should we not accept it?

Whether or not the above suggestions contribute to the attainment of such a result, the desideratum clearly is this: That, given the dimensions of the window in the dominant tenement and the position of the obscuring horizon, we should be able at once to lay down a definite line of limitation, any material transgression of which by the owner of the servient tenement, except in so far as such transgression interfered with the enjoyment of that which the owner of the tenement had elected no longer to enjoy, would constitute, *ipso facto*, a breach of the prescriptive right.

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[1] In this and the following examples, the original window is, of course, assumed to have been blocked up when the new light is opened.

[2] *I. e.*, to pencils from a specific point in the sky area,—inclined at any specific angle to the vertical. This is presumed to be the meaning of the expression used in the judgment above mentioned, of Bowen, L. J. (see 31 Ch. Div., at p. 572),—"The pencils of light which had passed through" the original aperture, etc. But pencils of light falling upon two windows in the position *a b* and *e f* respectively (see Fig. 3) must of necessity either come from *different* points in the sky area, or *differ* in their angle of incidence; whereas a considerable number of identical pencils would pass through *a b* and *c d*.

[3] *g f l* would represent the original volume of light illuminating *e f*, as shown in section.

[4] Which varies as the intercepted area of sky.

JOINTS IN WOODWORK.[1]—III.



1

In a previous paper reference was made to the importance of considering the effect of shrinkage in timber in forming joints of all kinds, and it was shown how the effect of shrinkage or expansion in the timber would have the effect of altering the angle of any piece cut obliquely. A case of interest, to which it is worth while making reference, is that which sometimes arises in door trimmings of the old class, in which corner blocks are not used. The moulding or architrave is mitred at the corner, and where imperfectly seasoned timber is employed, the joint will open at its lowest part. In some cases, however, it will open at the top, although not frequently.

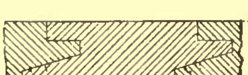
A case occurs to the writer in which both descriptions of opening in the joints were found in the same house, although a uniform quality of timber had been used throughout. Having in mind the manner in which timber shrinks, the cause of this was not far to seek. In those door trimmings in which the architrave opened at the bottom the timber shrank, as will be understood from what has already been said. In those doors in which the mitre opened at the top, the doorways were located in a damp place, and as a consequence became swollen. The correctness of this explanation was shown by the fact that all the mitres opening at the bottom were in the upper part of the house, while those opening at the top were without exception situated in the basement.

The manner of forming the connection between thin boards, such as flooring, sheathing and clapboards is of importance, for here it is that it is of great moment to allow for shrinkage, to prevent cracking and other damage to the parts. The simplest form of laying flooring is that sometimes known as "folding" or "shot edges," in which the boards are laid side by side, and are forced up closely to one another. The objection to the opening of the joints brought about by shrinkage may be overcome by grooving and tongueing, by rebating and filletting, or by any of the other usual means which are too well known to need any description here.

As illustrating the manner in which special joints of this kind have been formed, we give a few of the principal joints for which patents have been taken out in recent years. It is often interesting and useful to observe the thought that has been given to the improvement of any particular contrivance, as exemplified by the patents in the United States Patent Office. Generally speaking, the public are familiar with the broad and generous rules by which patents are granted on the smallest and often most insignificant improvements, but many would be surprised to find the extent to which this is carried.

An improvement in joints for sheathing is represented in Figure 1. It is designed to prevent warping, splitting and opening of joints, and was patented by N. G. Northrup in 1873. Both edges of the board are grooved, formed with rabbets, and blind nailed to the studding. The joint would probably prove very effective, but it is doubtful whether the considerable labor necessary in forming the joint is required, excepting in extreme cases.

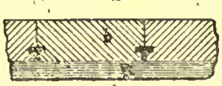
Figures 2 and 3 show two forms of a joint for flooring, which formed the subject of a patent granted to Edward M. Kuhn in 1876. It relates to improvements in joints in that class of wood-flooring which may be termed "nailless," *i. e.*, those in which no nails appear on the surface. The joint is a good one, that represented in Figure 3 being, in most cases, the better of the two, as there is a greater amount of timber for the nails to pass through, and hence a stronger floor is the result.



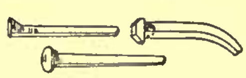
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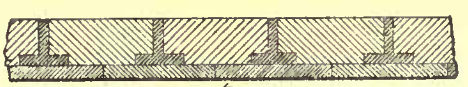
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4



5



6

A floor of a somewhat unusual description is shown in Figure 4, which was patented by O. S. Dickinson in 1877. In this the floor proper, *B*, is covered with blocks *b*, which are held in position by T-strips nailed to the floor, the blocks being grooved to receive them. The construction is most suitable for those floors which require to be particularly smooth and constructed of hard wood. In the case of soft wood there would be a strong liability of the small projecting fillet beneath the groove breaking off.

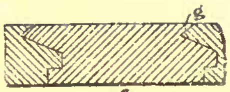
The nails represented in Figure 5 are employed in forming a floor under the patent of C. Mudge, granted in 1878. These nails are provided with obliquely projecting heads, and are driven through the lower exposed corner of square-edged boards in such a manner as to leave the head exposed, so that on the next board being driven up close to the first, it will be secured by these heads. The system is probably not to be much commended, although it effects a saving of some amount of time and labor.

William L. Dolbeare in 1822 patented a waterproof floor, shown in section in Figure 6. This is composed of covering-boards, superimposed with a course of rebated planks, with an elastic, water proof material between them. The system is a good and effective one for certain positions, such, for instance, as piazza and other outside work.

The chief merit of the system of John R. Baldwin, indicated in Figure 7, is the concave-shaped recesses beneath the boards, which are provided for the purpose of permitting a current of air to pass beneath, for ventilation. It will be noticed that the connecting tongue between the joints is rounded on its edge, but this is not covered in the claim of the patent.



7



8



9



The only difference between the joint in Figure 8 and those in Figures 2 and 3 is in the inclined upper surface, *g*, which prevents the board from springing or rising, it being held down by the inclined surface above it. This forms a very good illustration of the rule upon which patents are granted. The improvement here, although slight, is of some practical benefit, and hence a patent was granted upon it, but only upon the improvement, for the claim distinctly limits the extent of the patent to the inclined edge. This system was patented in 1885 by Alfred Putney.

By the invention of W. I. Conway, patented in 1886, it is claimed that the doubly-inclined grooves will have the effect of producing a better plane-surfaced floor. In some cases concave recesses may be formed beneath each board to allow of ventilation, such recesses being formed of sufficient depth to permit of a current of air, but not deep enough to injure the boards. The claims on the patent allowed for and included both the doubly-inclined grooves and tongues and the concave recesses, although it is difficult to see how there is any substantial improvement on the hollow space over that of the invention of Baldwin shown in Figure 7.

The joints in Figure 10 are intended for the siding of buildings. The boards are cut away to form a watershed with an inclined nailing edge. The joint is a good one, if somewhat elaborate, and is very similar to that represented in Figure 1, the inclined nailing edge being the only material improvement which is apparent.

ARTUS.

[1] Continued from No. 592, page 208.

THE ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

STORE OF MESSRS. J. H. PRAY, SONS & CO., BOSTON, MASS. H. H. RICHARDSON, ARCHITECT.

[Gelatine Print, issued only with the Imperial Edition.]

CUMBERLAND NATIONAL BANK, BRIDGETON, N. J. MESSRS. HAZLEHURST & HUCKEL, ARCHITECTS, PHILADELPHIA, PA.

The building is situated on a lot 28′ 6″ x 60′ 0″, at the corner of Commerce and Laurel Streets, having an angle entrance. The materials are Carlisle red-stone up to first-story window-sills; above which are Philadelphia pressed bricks, laid in red mortar, with string-courses of Peerless moulded bricks and carved Carlisle red-stone. Cornices, crestings, etc., of galvanized-iron. The banking-room is 35′ 0″ x 40′ 0″ x 29′ 0″ high, finished with mahogany and cherry. The walls are wainscoated with panels to a height of about 5′ and has a covered ceiling. This room is lighted by two large arched windows, filled with leaded glass above transoms. The building is now nearing completion, and will cost, exclusive of vault, about $16,000.

ST. GEORGE'S REEF LIGHT-HOUSE, NEAR CRESCENT CITY, CAL.

For description see article on "Ancient and Modern Light-houses" elsewhere in this issue.

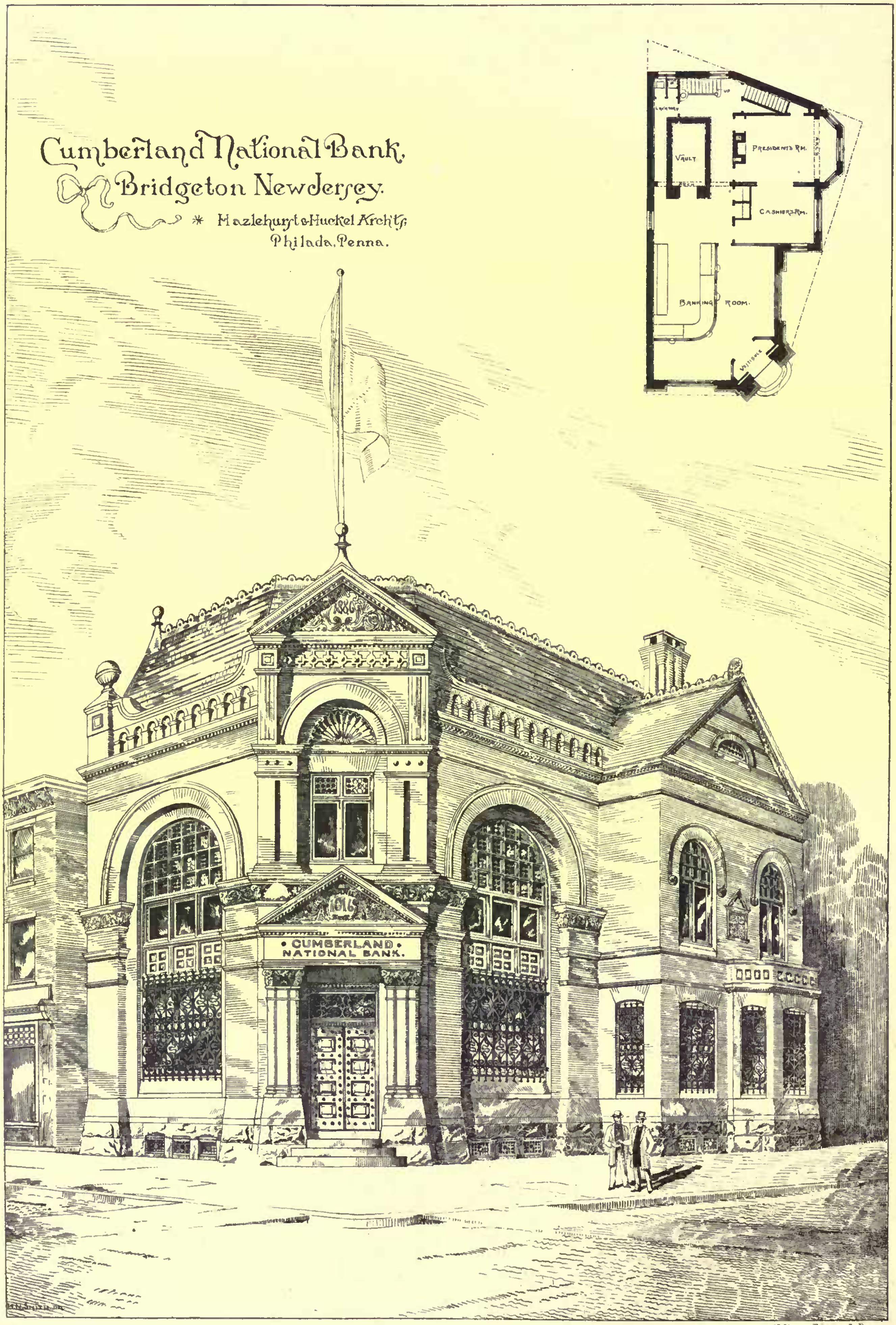
COMPETITIVE DESIGN FOR THE KANSAS CITY EXCHANGE, KANSAS CITY, MO. MESSRS. COPE, STEWARDSON, JOHNSON & TRUSCOTT, ARCHITECTS, PHILADELPHIA, PA.

DESIGNS FOR A CITY HOUSE.

To these two designs were awarded the highest rank as the outcome of one of the problems recently submitted to the architectural students of the Massachusetts Institute of Technology.

SPIRE OF THE PARK STREET CHURCH, BOSTON, MASS. SKETCHED BY MR. HENRY BACON.

TOWER OF SAN MIGUEL, SARAGOSSA, SPAIN.

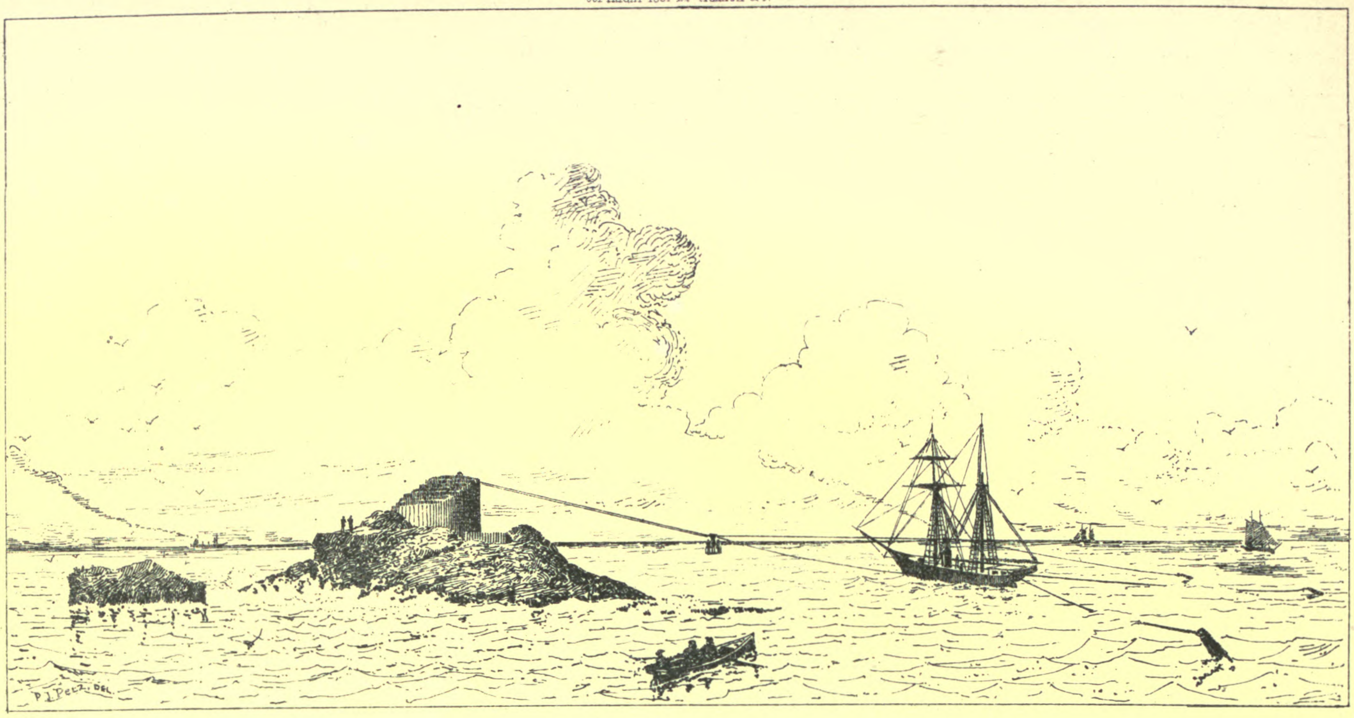


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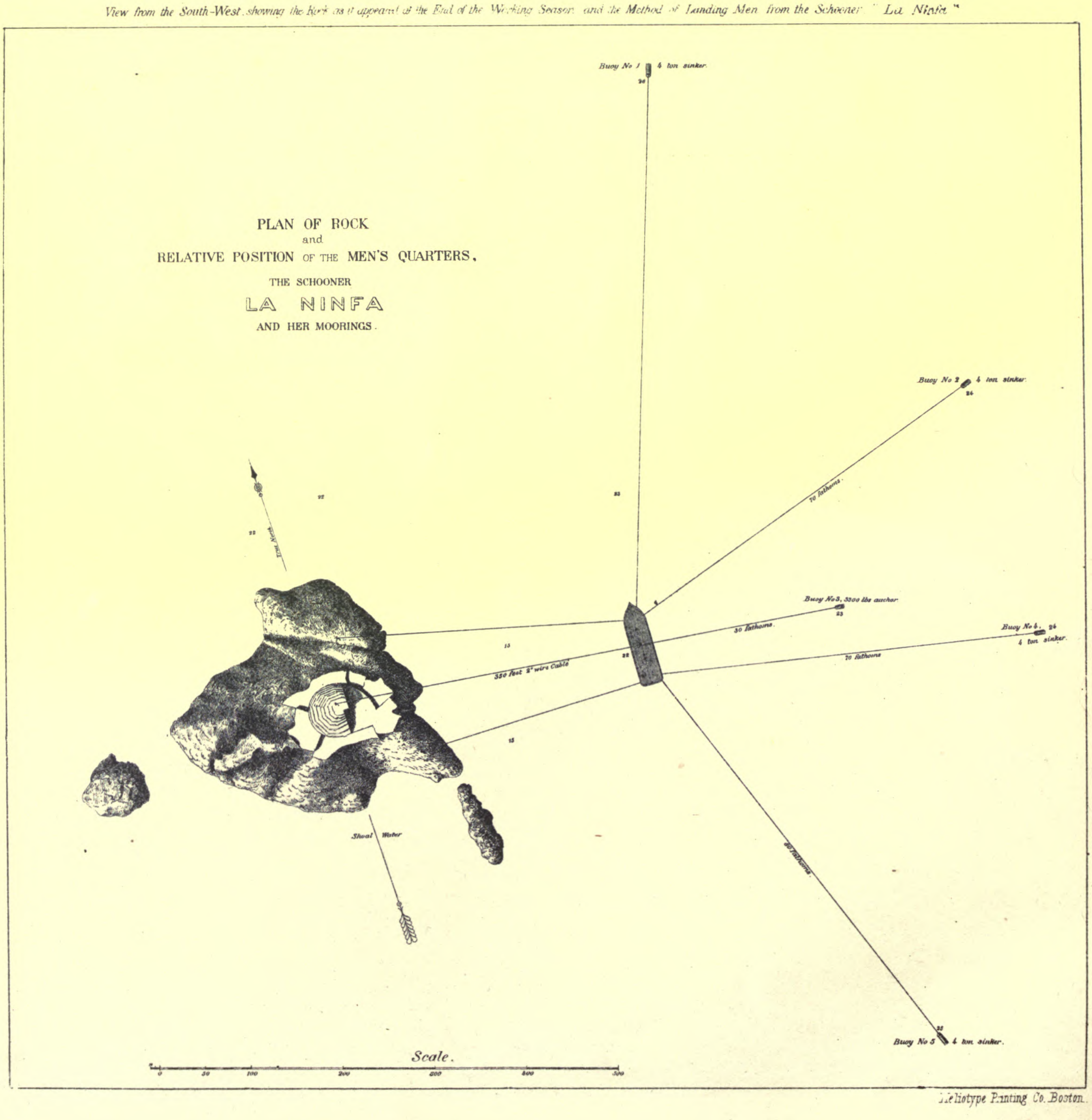
Heliotype Printing Co. Boston

Tower of San Miguel: Saragossa, Spain:



ST. GEORGE'S REEF LIGHT STATION.

View from the South-West, showing the Rock as it appeared at the End of the Working Season and the Method of Landing Men from the Schooner "La Ninfa."



PLAN OF ROCK
and
RELATIVE POSITION OF THE MEN'S QUARTERS,
THE SCHOONER
LA NINFA
AND HER MOORINGS.

Heliotype Printing Co. Boston.

PARK ST. CHURCH STEEPLE
BOSTON MASS

Henry Bacon Jr. Del



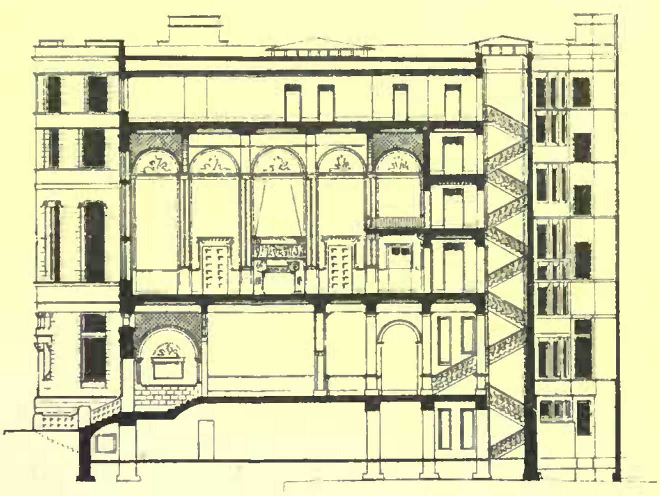
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AMERICAN ARCHITECT AND BUILDING NEWS, MAY 14 1887. No. 594

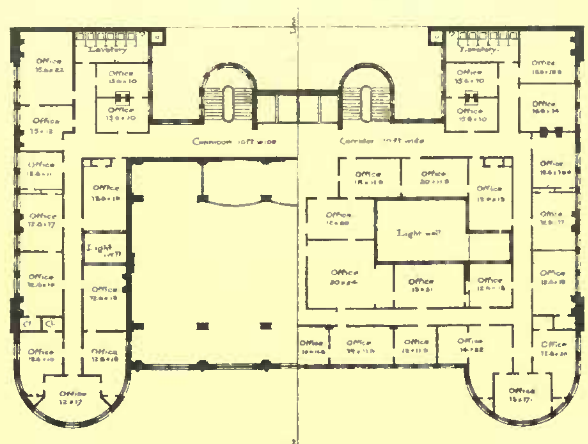
KANSAS CITY EXCHANGE.
COMPETITION.

LINDLEY JOHNSON.
WALTER COPE.
JOHN STEWARDSON.
ARTHUR TRUSCOTT.
ARCHITECTS. PHILA.

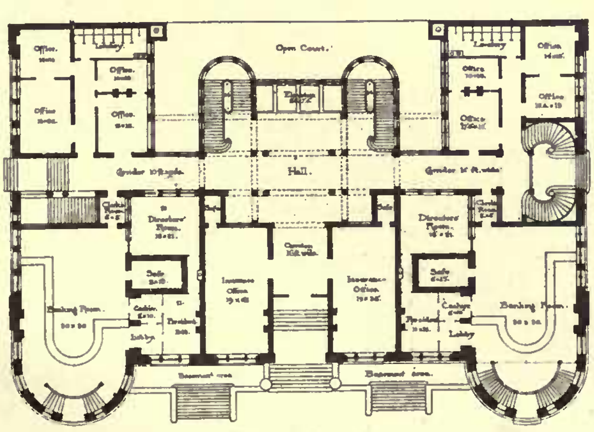




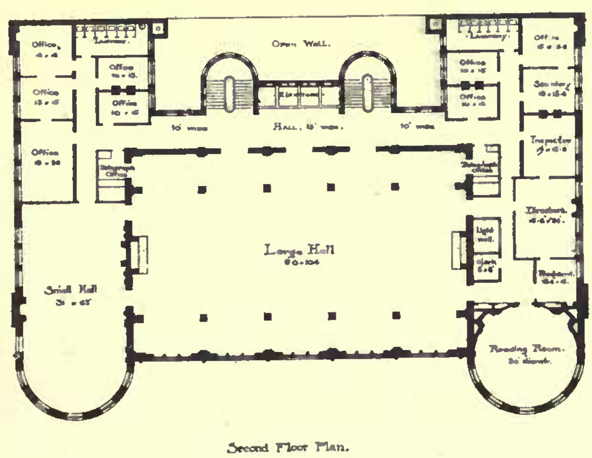
Cross Section.



Fourth Floor Plan. Fifth Floor Plan.

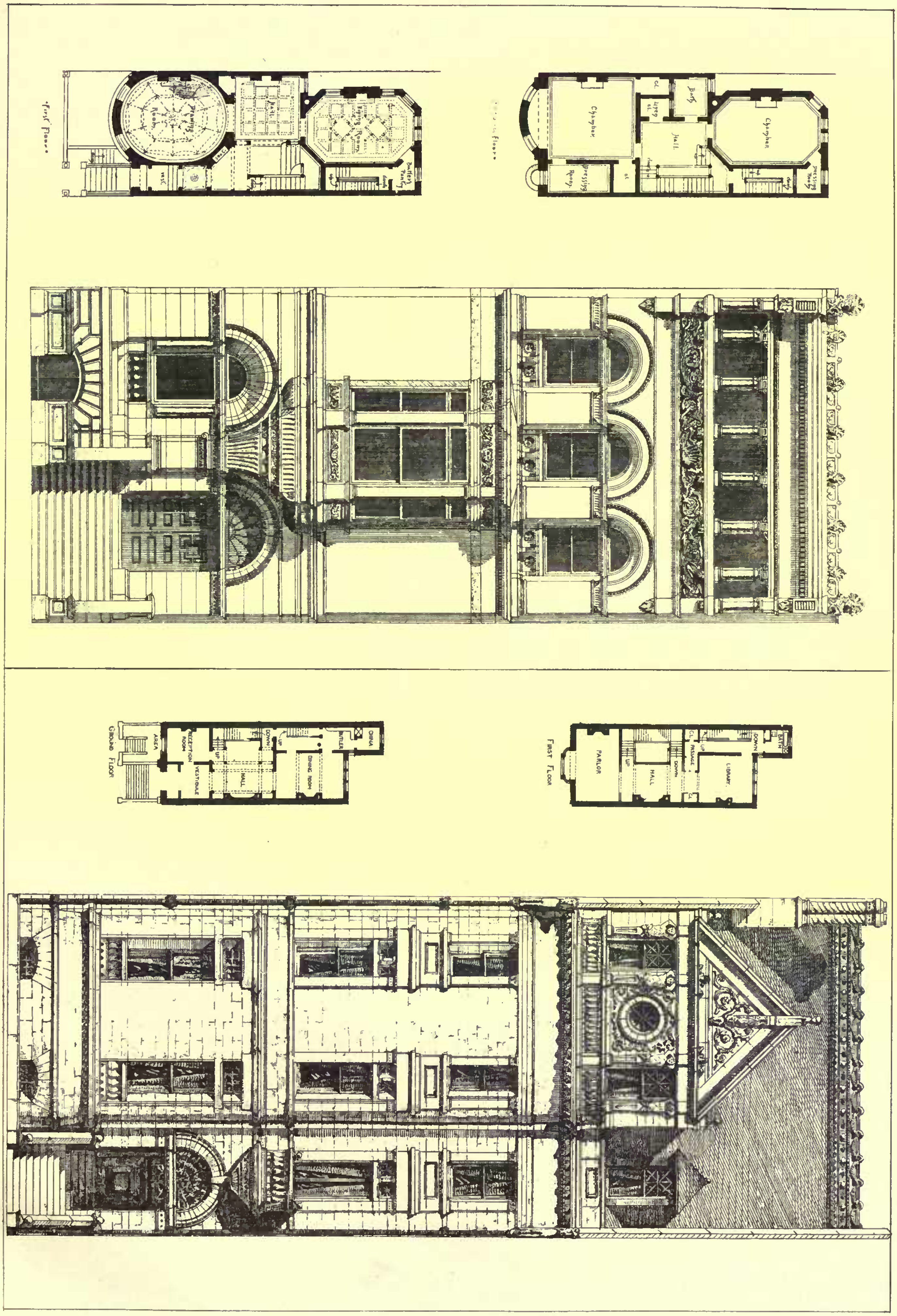


Plan of Principal Floor.



Second Floor Plan.

··Designs·by·Students·of·the·Institute·of·Technology··



Heliotype Printing Co. Boston.

VARNISHING DAY AT THE ROYAL ACADEMY.



Sketch of Beach House at Winthrop Highlands, for H. H. Hutchins, Esq. G. F. Loring Architect.

THE artists' days at the Paris and London picture-shows vary considerably. At the Academy one sees artists touching up their works, and workmen varnishing; men and women in very *negligé* attire — ulsters, "greenery-yellowy" gowns, and Tam-o'Shanter hats; the parquet floors covered up with felt; sundry pictures covered with newspaper and glazed calico; and withal, a general tone of behind-the-scenes dirt, dust and muddle, added to which a very loud smell of varnish. Here and there an R. A., but the mass of the crowd are the young outsiders. At the *Salon* the same dirt and dust and varnish, the same steps and ladders, the same general appearance of before the show, but there the likeness ends. In Paris the varnishing-day is one franc entrance to the public — formerly it was a matter of invitation to "all Paris," artistic, literary, and amateur — but the happy thought of gaining a bag full of ten-franc pieces occurred to some of the artists, and the crowd is bigger than ever. And such a crowd! "All Paris," and much beyond. And the costumes! Not "artistic," but the height of fashion. In fact, it is the Academy Varnishing Day and Private View rolled into one.

I have sometimes called the attention of your readers to the fact that the artists, or would-be artists, of the United States do wisely by going to the best school of artistic culture, to wit., Paris, for their instruction; and I have predicted that the American school of painting and sculpture will probably, fifty years hence, be far superior to the British. This year's show in London makes me more hopeful for our future; and I think it may become a fraternal race between the older and the younger members of the British family. There are a number of young men now coming to the fore that are distinctly French in training. Mr. Solomon's "Samson and Delilah" might be the work of a Prix de Rome — he may be for ought I know. It is intensely powerful in the Rochegrosse and Sylvester manner, wanting entirely in charm, but vigorous in handling, and good in color. "Delilah" might be handsomer, and the composition is confused; but it shows immense command over materials. Only compare this work with its neighbors! a whole mass of the wishy-washy schools, utterly void of any attempt at *technique*, or anatomy. Now that Mr. Solomon has shown us two years running what he can do, now that every one has been compelled to look at him, we shall be glad if he will give us something as vigorous, but less revolting than "Samson." Another school which is strong this year is what, in French, I should call the *enveloppé* — the only English word that occurs to me is a bad one — bleared. Messrs. Bramley, Forbes, Kennington, Kimley, Fisher, and Fletcher, all belong, more or less, to this set. Your countrymen, Messrs. Bridgeman and Sargent are well represented, the former by an Eastern court-yard full of sun and air, the latter by a fine portrait of Mrs. Playfair, in evening dress and an opera mantle, and an evening fête, which I like less. This picture is in one of the smaller rooms, and to see it properly is impossible — perhaps at a greater distance it would look better, but as it is hung, the light of the setting sun, and the artificial light of the lanterns are confusing. *The* picture of the exhibition will probably be Mr. Waterhouse's "Herod's Wife," (though I must remark that Sir Frederick Leighton's and Mr. Alma Tadema's are covered up.) Mr. Waterhouse's work is excellent — vigorous, rich and masterly. The other *the* picture, is Mr. Orchardson's. It is very well to ridicule this painter's habit of "canvas to let," but with less his figures would be far less effective. The husband, or "that brute," as I heard a young painter truly call him, is a marvel of impertinent easy nonchalence; and in the attitude of the girl and all the surroundings Mr. Orchardson has surpassed himself. The tone is the usual golden hue, and the painting is the usual slight work of the artist; but he is at his best, and he stands alone — no one has ever ventured to follow his ways, or, happily, to attempt to imitate him. The portrait of some lady in black, with a high collar, is the best in the exhibition; and this is saying much, for good portraits abound. Mr. Carolus Duran's full-length standing lady, Mr. Herkomer's and Mr. Holl's, are all first-rate; and Mr. Filde's is thought to be by some *the* portrait. It is splendidly painted; but I prefer Mr. Orchardson's — I have always had a weakness for the latter's style of work. It was said that Sir John Millais was so smitten with his "old-style" of painting that he was going to astonish us with a second edition of the "Huguenot." I cannot say I am at all astonished, except in so far that any one should be astonished at the new edition. The "Huguenot" in its way is perfect; and the "Yoemen of the Guard" and "Cardinal Newman" are also both perfect in their ways; but this new combination is, I venture to say, not at all worthy of the painter. M. de Blaas is another who is not so good as usual, having taken to life-size work; but another foreigner, M. Fautin, sends a charming portrait. Yet another good portrait is Mr. Skepworth's; and a quaint family-group by Mr. Marks, of Penguins, is delightful. Of course, there is a vast amount of imbecile work, by members and outsiders; but of that school the less said the better — indeed, I scarcely noted it; and equally, of course, some of the covered-up works were, no doubt, worthy. This only pretends to be a glance at the exhibition through ladders, and artists, and varnish pots.

PENGUIN.

SOCIETIES

DECLARATION OF PRINCIPLES PRESENTED TO THE ASSOCIATION OF MASTER-CARPENTERS OF CHICAGO BY ITS EXECUTIVE COMMITTEE, IN THE FORM OF A REPORT, AND UNANIMOUSLY ADOPTED BY THE ASSOCIATION AT A REGULAR MEETING HELD APRIL 14, 1887.

TO THE ASSOCIATION OF MASTER CARPENTERS OF CHICAGO:

Mr. Chairman and Gentlemen, — Deeming it proper that you should have a full report of those matters which have occupied our attention for the past few days, and that we should not only report to you the results, as far as reached, but to some extent explain to you our reasons for our course of procedure, we present to you the following:

The facts are that a week ago last Monday the journeymen carpenters throughout the city struck work without notice to employers. A mass-meeting of contracting carpenters was held on Wednesday, and a called meeting of this Association was held Saturday night last. By mistake, and through no fault of this Association, the impression got abroad that this was also a mass-meeting, and many who were not members came, and not being admitted, went away dissatisfied and feeling that in some way they had been ill-treated. At that meeting a notice was received purporting to come from the Executive Council of the Carpenters' Union, making certain demands. This writing had neither letterpress or seal to distinguish it, and was, as you know, simply signed "The Executive Committee." It was brought by three parties, who said they were members of the executive council of the Union. We sent one of this executive committee to the executive council of the Union to ask for a written statement of their demands or grievances, over their signatures, and also to ask them for a copy of their constitution and by-laws, that we might have something to work from in our endeavor to settle the strike in the interest of the journeymen and of ourselves. They refused to make any further statement, said they had no seal, would give no other signature, and would not give a copy of their constitution and by-laws. After thus trying by all fair means to get the demands of the striking carpenters in writing from their executive council, and being unable to do so, we concluded they had no real representatives, and any demands we could get from them would be prompted by malice rather than fairness.

The advisability of advertising throughout the country for men was fully considered by your executive committee, and it was decided not to do so at present; mainly in the interest of humanity, considering it unjust to the journeymen living at a distance to bring them here when they might have work but a few days; as it has become more apparent day by day that the men in Chicago will all go back to work when they feel they can do so with safety.

We have been careful that you, and the public as well, should be kept fully informed of the situation through the daily press, and it is due the papers of Chicago to say that they have been uniformly fair, and have sought to give the facts as clearly as possible, without exaggerated or sensational features.

We have, in considering the present crisis, and the speedy settlement of present difficulties, gone farther and tried, as far as possible, to lay such plans as would make any settlement that might be arrived at permanent and lasting. We would urge upon you the wisdom and necessity of this. We believe that mistakes have been made by this Association in that we have allowed ourselves to take action that has been construed to mean that we deny the journeymen the right to organize. This is a right that lies as a fundamental principle of American liberty, and belongs to all men and classes of men. What we have meant is that we deny the right of any man, or class of men, to seek to abridge or govern the freedom of action in another, and this principle we can neither violate ourselves or allow others to take from us.

We must, therefore, settle this difficulty upon the broad principle of right, both for our own interests and for those of the journeymen. Our interests and theirs are not antagonistic, but are mutual. We are all workmen together, and we can never disagree without doing equal injury to both.

These are, as we have said, some of the results that have come from four days of the closest study of the situation, its present aspect and future needs. We have thought that before we went any

farther, in order to prevent mistakes, and that we might have a line to follow that would be plain, the right of which would be incontrovertible, we propose to you the following resolutions, hoping that after careful deliberation that you will accept them as a declaration of the principles of this organization, and from which, in all our actions here or in future dealing with the journeymen carpenters, there can be no deviation. Holding, as we do, that these resolutions sustain and protect the rights of our workmen as well as of ourselves, and that their passage and recognition will give to the journeymen a greater freedom than they have yet enjoyed, and will enable them to see exactly how we stand, they will also give to the public the assurance (which, at this critical moment, is extremely necessary), that we are level-headed business men, and not hot-headed cranks. The resolutions are as follows, and we ask your earnest attention to each section:

As we think the journeymen reasonable men, willing to repair a wrong committed, and acknowledge undoubted rights, be it

Resolved, That the Master-Carpenters will, as a preliminary to any negotiations with the Carpenters now on strike, require that the men now on strike without notice to their employers, agree to resume work at the following scale of wages, to be agreed to by employers and employés, viz:

Eight hours to constitute a day's labor at 30 cents per hour and upward according to the skill or efficiency of employés.

Resolved, further, That the Master Carpenters lay down the following rules as a declaration of principles, as the unquestionable rights of employers and employés, upon which there can be no arbitration or question. These rights to be conceded by both parties before any further action is taken looking toward a final settlement of differences for the future.

Rule 1. The right of the employer to employ and discharge employés whether belonging to the Carpenters Unions or not.

Rule 2. The right of the employé to work or not to work with non-union men.

Rule 3. The right of the employer to hire unskilled labor that will suit his purpose at any price at which he can get it.

Rule 4. The right of the employé to get the wages he demands, or not work.

Rule 5. The right of individuals to associate for all honorable purposes.

These rules lie at the foundation of all liberty of action, and must be recognized before any prudent business man will invest capital in any enterprise requiring the employment of labor.

Respectfully,

W. H. Woodard,
Jonathan Clark,
John Ramcke,
Sam'l H. Dempsey,
Francois Blair,

Executive Committee, Association of Master-Carpenters of Chicago.

BOOKS AND PAPERS.

One of the commonest idiosyncrasies of human nature is the unwillingness that men have to look on both sides of a question. How many ardent Republicans, for instance, can tolerate a Democratic newspaper, and how many good believers in Orthodoxy would read a Unitarian Sunday paper? And yet, what is probably more common than for these bigots to proclaim their inability to understand how it is that laboring-men can pursue their wrong-headed policy of strikes, riots, starvation, and loss of money, in the face of the evidence of the hard facts of the past, and in spite of all the arguments that the observer of sociological movements can shower upon them in the columns of the daily papers.

The simple fact is that just as the exhortations of the good Republican are not heard within the lines of the Democratic camp, so the workmen rarely see the words of commonsense and real wisdom that the rest of us see every day, and find so obviously convincing. Like a good many other people, the workman will read and listen to only those words which state his side of the case as he likes to have it stated, and he finds plenty of papers — whose very existence is unknown to his employer — which will cater to his views.

In many ways an uneducated, or imperfectly educated man has to be treated like a child which is given unpalatable physic, for its own good, that is, as the preconception is difficult to remove a harmless disguise must be adopted, — the pill must be sugar-coated.

It is not much in our line to speak of novels, but as many of our readers are large employers of labor and may, at any time, have on their hands a contest with organized labor, the majority of whose forces are disbelievers in the course of action into which their leaders and the minority have forced them, we think it well to draw their attention to this book which, it seems to us, is just the sugar-coated pill that could be administered to the workmen either in homœopathic doses by placing a single copy in the mill-library or the reading-room of the association, or allopathically by using it as a tract, and distributing copies, broad-cast, to all the workmen in a given employ.

The book[1] is one which has action enough to pass simply for a novel such as are written for summer reading. But it is more than this; it is a novel with a purpose, and that purpose is a fair consideration of the great labor movement of to-day and the chances of success that attend the directors of the Knights of Labor. A novelist makes his puppets act and speak in furtherance of his own views, but this author does not seem to have used his privileges unfairly, but tries to give both sides of the matter a proper presentation, as the following conversation between the superintendent of the mill, whose operatives have just struck, and the representative of the labor organization will show:

"Mr. Darragh," said the superintendent, as he entered the office, "I am glad to see you — and you alone. From what I know of you, I believe we can settle this matter, and have the men back at once. Provided," he added, "than I can induce the directors, who have taken this matter in hand themselves, to waive their principles, as some seem to regard the matter, and allow a settlement with your organization."

"I hope they will do so, I'm sure," said Darragh, cordially. "They tell me — those men who seem to know — that if your advice had been followed in the past, there would have been no occasion for a strike here."

"How do you like our scale of wages?" he added, after a pause.

"Well—but sit down, sit down," said Mr. Malcolm. "The schedule?" he continued; "I do not regard it as unreasonable. If you'll shade down the back-boys and helpers — make that half a dollar a week less, I should say — and if you do not insist upon your peculiar method of equalizing those machine-shop wages, I have little objection — by the way," he said, interrupting himself, "in that machine-matter, I might as well say that I am entirely opposed to anything that tends, even in a slight degree, as here, to put a poor workman on a par with a better man. Your schedule there makes a very few dollars a week difference to us, but I hate the principle of it. A good workman ought to have exactly the difference in pay over the unskilful and lazy one as the ratio of his work is to that of the other, in quantity and excellence. Their being at work the same number of hours does not go for much in a machine-shop. There is no piece-work there, you know."

Darragh looked thoughtfully at the list that he was holding in his hand.

"This," he said, finally, "is one of the ways in which our order sometimes works injustice. I am only reconciled to it on the principle of the greatest good to the greatest number. You had better let it go, or, I fear, we shall have a strong kick against our settlement." . . . .

The superintendent twisted his chair around, and thought a moment or two.

"Well," he said, slowly, "if the men are fools enough to stand it, I don't know that I ought to fight for them against their own order — but there is one thing more. Is there to be any trouble about the 'scabs,' as your brethren pleasantly style them? They comprise nearly three hundred men and women, and we do not propose to discharge one of them."

Darragh threw his head back, running his fingers through his thick, black hair, and presently answered with some deliberation.

"With regard," he said, "to the proper attitude of our order on this question, I am very clear. Our best men also," he added modestly, "have given the subject a great deal of thought, and are satisfied that nothing can ultimately work us more injury than to assume a hostile position toward those who do not choose to join our ranks. For a time some may be intimidated and driven in, as it were; but such recruits are of little value. Too many are already in the organization who sadly fail in understanding its high purposes, and seek to pervert it to selfish and unlawful ends, without adding to it members who shall sow discord to be reaped hereafter —"

Mr. Malcolm here interrupted him, speaking in his usual slow manner.

"Your order has in itself now," he said, "the seeds of dissolution. It cannot last. None of you with any self-respect can long endure its tyrannical interference in your private affairs. The thing is an anomaly in a free country — an *imperium in imperio* — that can have but a brief existence here. It is bound to fall to pieces of its own unwieldness, or be shivered to atoms by a storm of public disapproval, both within and without its ranks, when its full significance and baleful workings shall more fully develop themselves. Excuse my warmth; but I think your order is doing great mischief."

Mr. Darragh heard him with admirable temper, and answered quietly, "Certainly: there is some ground for your strictures upon us, I regret to say. All associations, of this or any other character, must share in the imperfections of the men who compose them. No movement for the amelioration of the condition of a large class of the people can be conducted without more or less incidental friction, and the infliction of temporary hardship upon many, perhaps. But, Mr. Malcolm, unless you fully grasp the ultimate objects of this association, which are to elevate the laboring man, and broaden and ennoble his life, these incidental objections are seen by you out of all proportion, for you do not understand us at all."

"How?" exclaimed the superintendent. "Do you mean to say that these boycotts and the violence, injustice, and cruelties that your people are constantly practising are to be looked upon as mere 'incidentals' of some far-seeing policy of self-elevation and improvement? They are your methods, sir, not incidentals; and no such methods can lead to those high results."

"Violence," returned Darragh, warmly, "or lawlessness of any kind, the order strictly forbids and seeks to restrain" —

"I don't know about the forbidding," interrupted Malcolm, "but I do know about the not restraining."

"We do our best, sir," said Darragh.

"Well," said Malcolm, "your 'best' has been very bad indeed, so far. You seem to have discipline enough to successfully order free citizens to stop work, but you are not able to make them behave themselves like men — or you don't wish to — one of the two."

"I think you do us injustice, sir," said Darragh. "Our principles are opposed to all illegal methods. Boycotts are only permitted in extreme cases. Strikes we order, it is true, but always prefer to settle

[1] "*The Strike at the B—— Mill.*" A Study. Boston: Ticknor & Company, 1887. In cloth, $1.00; in paper, 50c.

matters without them. Do you not see, Mr. Malcolm, that to lift the laboring man, to improve him intellectually and morally, we must improve his material environment; help him to the getting of larger wages, and more leisure for self-improvement. But it is difficult, I presume, for a capitalist to feel as I do about this."

"Mr. Darragh," replied the superintendent, "I am now, to a certain extent, a capitalist. But I have been a day laborer, and do not forget it. My sympathies are all your way, whatever you may think about it. But your claim is an impossible one. Many desirable things are denied in this life to most of us; and before you bind together a number of hundred thousand men, with this ultimate purpose, and through such association bring upon many of them hardship, suffering, and disappointment, is it not your duty to be tolerably sure that the economic conditions of the country — of the civilized world, indeed — will admit of these radical changes? You cannot do these things by edict, beneficial as they may be. The laws of supply and demand are inexorable, and the minute you begin to force a change in them by law, or by a movement like yours, that minute the quick destruction of many industrial enterprises has begun. What the end shall be, if you persist, you can foresee as well as I. Where will be the advantage to a man of large wages, when he can find no employment; and will your people desire an eight-hour rule, when every hour of the day will be at their disposal for want of occupation? Look ahead, man, look ahead."

"The question is not altogether free from difficulties, I am aware," said Darragh. "But we must strive for the best. We can but try, and if we fail it will not have been our fault."

"Yes, Mr Darragh, if you, the men of intelligence, go ahead blindly, and mislead a host of people with sloppy rhetoric and vain hopes, and leave them worse off than they were before, it *will* be your fault. You ought to be fairly sure of your ground. You have no right to make experiments that involve so much possible injury."

Darragh colored, and his eye flashed. He arose from his chair and walked a moment up and down the room. Then, controlling his feeling, he said, almost pleasantly: "By the present strike, at least, Mr. Malcolm, we are likely to have the men back at work in a few days, with a material gain, if we agree, as I suppose we shall, when our discussion is over."

"Yes," said the superintendent, "we shall agree about the wages. But my directors must endorse my action, and your people, I take it, must back up your very sensible notions about the non-union men. When this has been done, you can indeed congratulate yourself upon one of the very few successful experiments of your order in righting a wrong."

"You admit that there was a wrong for us to right?"

"Yes, as prices go now; you are quite welcome to that admission. But we have gone to our limit. If your folks strike again, as they logically must, some time, in order to make progress toward the goal you point them to, they cannot be successful. We can pay no more and live. Indeed, it is a problem as to how long we can pay this. Your strikes have forced a few men, here and there, to pay more than they can afford; but they cannot hold on very long Most of those strikes have failed, however. And all fail when, as in the majority of cases, they hold out on some absurd point outside of the question of wages or hours."

"*Those* strikes ought to fail," said Darragh.

Mr. Malcolm rose from his chair. "We have had a long discussion, Mr. Darragh," he said. "I respect the desire you have to benefit the people, but regard your hopes of what you can do in this manner as in the highest degree chimerical. Meanwhile, I cannot help adding that, while your order may gain an incidental advantage, now and then, the mischief you are working and will work to your own people, before this organization goes to pieces, is incalculable. In your experimental striving for the best, as you call it, you are marking off into a distinct and inferior class a large body of the citizens of a free country, to which I came, and in which I had a chance to better myself, because there were no classes. You are destroying their independence and crushing out their individuality. The 'Associate of Toil' can only stand on a dead level with his fellows, though it may be he is their superior in brains and pluck. From a free and untrammelled citizen you are transforming him into a mere unit of labor. All this in addition to the untold misery and trouble that these movements entail to him and those dependent upon him."

"You do not justly estimate us," said Darragh. "We must be judged by results. Have not the trades-unions benefited the English workman?"

"Yes," replied Malcolm, "though the extension of the suffrage there has done far more. But it does not follow that your organization is to do good here. The conditions are essentially different. Because the Russian peasants need reforms, does that justify the mountaineer of Switzerland in raising the devil with his free institutions? Associations like the Carbonari, or the Vehmgericht of the Middle Ages, may have served some good purposes, in their villanous way; but what do we want of them here? You cannot generalize about these things. What may be beneficial in one period, or in one country, becomes an absurdity and a menace to society in another. In the broad light of American freedom your order cannot endure, but will die like its wretched prototype, the Molly McGuires of Pennsylvania."

"Well," said Darragh, "that very light must act as a check, and will prevent what you seem to fear. We can restrain injudicious leaders, for the men have too much sense to follow them; neither can they go in for this nonsense about scabs and boycotting. We mean to be no check upon individual enterprise, and only wish to elevate all together without menace to liberty or disobedience to the laws of the land. If the order can be conducted as its best friends wish, I believe — yes, I fervently pray — that it will yet effect much good." He paused a moment, and his face showed some emotion. Presently he added: "I shall report to our meeting to-morrow night. I have confidence in our people, and believe they will vote to accept our settlement and go back to work if your directors allow of it."

We had intended, but lack of space forbids it, to quote also the conversation which occurred some time after the collapse of the strike, during which Mr. Darragh acknowledges with sorrow that the attempt to elevate the working man by the aid of a system of which strikes and boycotts were chief factors was an impossibility; that the earnest and well-meaning men were leaving the organization, and that the demagogues had got the upper hand and were bringing wrack and ruin upon the boasted labor organization.

ONE thing strikes the traveller in foreign parts, and that is that there must be some connection between the costume of a people and the architecture amidst which they dwell: at any rate it is observable that where there is a national costume there is generally a national architecture, and the costume seems more appropriate to that style of architecture than it would to any other. Indeed, it seems that if one were given a series of fashion plates, showing the national costumes of all the peoples in the world, and another series of plates showing the national types of architecture, it would be in most cases a simple matter to assign with certitude a given costume to its appropriate house. National costumes are affected mainly by the lower classes, and it is in the buildings occupied by the lower classes that the true types of the national architecture are to be found. As the worldly condition of given individuals improves they abandon the national costume, and in like manner the buildings they inhabit become less national and more cosmospolitan. Advancing another step, we find that as a nation becomes more civilized or more sophisticated, we will say, it abandons both the national costume and the national architecture at the same time. Perhaps the eclecticism in architecture which is more apparent in English-speaking races than it is elsewhere, may be due to the fact that they have no national costumes. Can anything be more lugubrious than a crowd of Englishmen or Americans in their sombre and unpicturesque garb, which somehow always suggests that the rite of "tubbing" is practised only by the upper classes, and that if one wishes to avoid contamination he must keep out of the crowd? The idea of uncleanness does not associate itself so closely with crowds who wear bright-colored and shapely clothes, though it is very possible that the homes where these gaudy individuals dwell may be less sanitarily wholesome than those which house our own dingy multitudes.

Personal cleanliness is in no small degree practised in the East by those who uphold the Mohammedan and affiliated doctrines, and there seems some little absurdity in the idea that an architecture suited to a race which rejoices in white turbans, robes and other washable wearing apparel should be thought suitable for English-speaking people who, we fancy, have among them an unusual portion of the "great unwashed," clothed in dingy and untidy woollen garments. On this view of the case it does not seem as if Mr. De Forest's book [1] of plates of Indian architecture were likely to be of great service even to our most eclectic architects, whose one idea in buying a book is to buy one which they can use — that is, crib from direct.

How out of place Indian architecture would be if bodily transplanted to this country may be imagined if one supposes the three natives shown looking out of the windows of the house in the Bazaar Amaritza replaced by any three of our own citizens with heads covered with the silk hat, the billy-cock or Panama. The proprieties would indeed be shocked.

But it is not necessary to copy baldly to derive benefit from such a book as this. Neither in taking inspiration from it is it necessary to go to the same extreme of elaborate enrichment, which would almost inevitably call into undesirable activity the jig-saw and glue-pot. To us it seems as if the true mission of the book were to suggest how much our somewhat sad and certainly prosaic lives might be lightened and brightened if they were passed amid architectural forms which had a lightness and gaiety of their own, which must react on the ephemeral creatures who live amongst their longer enduring forms. If the barren stretches of brick fronts in Philadelphia were to be replaced by façades designed by Indian masters, is it not supposable that the inhabitants would lose some of their Quaker sedateness and apathy, and discover that there were more enjoyable ways of living than that of rolling along smoothly in the same groove! Already our daily lives are affected, brightened, perhaps elevated by the change the artistic movement of the last few years has wrought in the interior of our dwellings, and though the transformation of our street architecture with its correspondent action must be an affair of years, we are already profiting by the achievements of artists of other times and races who have taught our artist-decorators how to embellish the interiors of our dwellings, even though we have not the means to apply analogous methods to the treatment of their exteriors. It is to the interior decorators that this book of fifty plates will be most useful, and though black-and-white is, in some ways, less satisfactory than color, it offers a safer source of inspiration.

We could wish that Mr. De Forest had written more at length concerning these excellent photographic prints — and where a book costs as much as this the purchaser should get the fullest possible return for his outlay; a little more information concerning the materials used and the method of construction would have added greatly to the value of the book. It is simply an aggravation not to be able to determine from the prints whether the materials are wood, stone, stucco or clay, and whether the decorations are applied color or inlaid in colored wood and stones. All we are told is that

[1] "*Indian Architecture and Ornament.*" By Lockwood De Forest. 50 quarto Heliotype plates. Boston: G. H. Polley & Co., 1887. Price $25.00.

teak-wood is a wood of wonderful endurance, and that, in it work of every degree of fineness can be executed, and that "shish" work is a kind of mosaic-inlay much in use in some parts of India, the peculiarity being that the inlaid pieces are cut from globes of various-colored glass, which are then set and combined so as to produce on walls and ceilings a display of color both brilliant and harmonious.

The views shown are rather unusual in that more regard was had for domestic than for ecclesiastical or public architecture; so that in the two doorways of the houses at Multan, the two bay-windows of the houses at Ajmir we have offered *motifs* which can be easily adapted to our American façades by those who like to do such things.

The subjects, as a rule, are well selected, and the reproductions unusually successful. Rarely does one see a more perfect print than the one which shows the interior of the palace at Delhi, which does not have the hard and unsympathetic perfectness of the print of one of the bay-windows at Ajmir. The Shet Huttusing Temple at Ahmedabad is another example of artistic photography. The plate which is, perhaps, the most interesting, architecturally, is also the most imperfect in the book: it shows a portion of the façade of a brick house at Lahore, and the peculiarity of the construction is that the window's heads are straight brick arches which, after the brickwork had become set, seem to have been cut into any arcuated form that struck the fancy of the designer.

Altogether the book is a more valuable and interesting one than that which Mr. De Forest produced a year or two ago, and of which we wrote in the issue of September 12, 1885.

COMMUNICATIONS

RABBET OR REBATE.

New York, April 29, 1887.

To the Editors of the American Architect: —

Dear Sirs, — Please state in some issue of the *American Architect* which of the following terms is correct: rabbeted or rebated jambs. By so doing you will confer a favor on A Few.

[Authorities differ about these words as they do about the verbs "to slake" and "to slack." Every-day usage is rather in favor of "rabbet" and "slack." — Eds. American Architect.]

ECONOMY IN DOMESTIC COOKERY.

Boston, May 3, 1887.

To the Editors of the American Architect: —

Dear Sirs, — I am constrained to believe that the improvements which I have made in cooking apparatus will ultimately prove most beneficial to people of small means rather than to others, but they may come into use sooner among prosperous persons than among the poor; they may then gradually find their way down to the points where they will do the most good. I think that I myself did not realize the full meaning of these improvements until I invited my Whist Club to an "Aladdin"-Cooker dinner-party on Saturday last. I may venture to give the bill of fare, which was promptly served and was very much approved.

The several dishes which were served on this occasion were prepared in the kitchen without any other instruction than a memorandum from myself as to the time to be given to each dish; they were cooked without any special supervision except that of two excellent women of average intelligence in our service — the work was done partly in the pantry and partly in the dining-room, without any odor of cooking of any objectionable sort, and without any heat more than that developed by a common kerosene lamp; the expenditure of fuel did not exceed two quarts of kerosene oil — I think not as much, worth five or six cents; perhaps worth less if oil is bought bythe barrel.



The quantities of food were substantially as follows:

10 pounds of sirloin of beef.
10 " leg of mutton.
4 grouse.
A large apple pudding.
3 loaves of bread, full size — the customary family loaf.
3 loaves of cake.
Sundry vegetables not measured.

Suffice it that the quality was indicated by the remark of an English friend who dined with us, that "the mutton was equal to the four-year old grass-fed mutton of England, and was the only leg of mutton that he had eaten in this country which approached that kind in its excellence."

The number of persons who partook of this dinner in the household was sixteen; what remained served for the dinner of twelve people on the next day.

The two devices are:

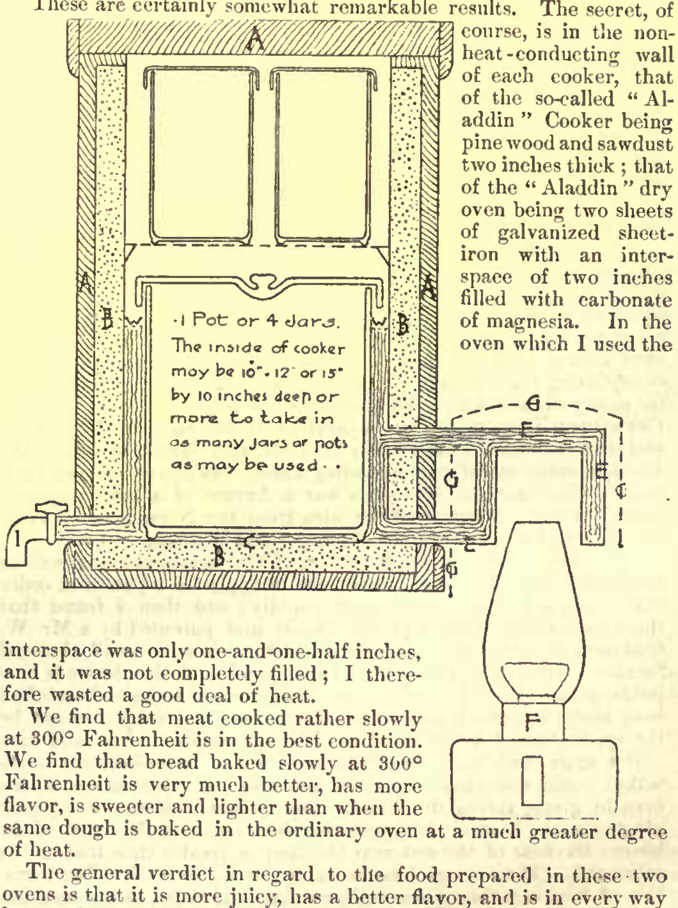
1. The "Aladdin" Cooker in which the food to be cooked is first placed in porcelain jars or pots, either with or without water or other liquid, and seasoned or not, according to taste. These jars are covered substantially air-tight, and are immersed in water by the circulation of which the heat is imparted. The diagram[1] will carry its own instructions.

The improved "Aladdin" as now made by Mr. A. W. Westgate, of Mattapoisett, is two-stories high. For the dinner-party named the leg of mutton was placed in a large porcelain pot in the lower part of the apparatus. A lamp was made use of of sufficient capacity to cause the water to boil, which causes the meat to simmer slowly in its own juice. The mutton was simmered four hours. One hour before serving, jars containing vegetables were placed in the upper story where they were cooked by steam. One large cooker was thus used, a small, one-story cooker for the grouse.

The "Aladdin" oven, so-called, is an oven in which the heat is imparted directly from the lamp to a space between an outer oven, the walls of which are filled with a non-conducting material, and the inner oven, made of sheet-iron or sheet-copper. The size of the oven which I used was substantially like that indicated in the enclosed diagram. I have made such changes in the arrangement in the diagram as will probably make this a better oven than the one which I used. In the hot-air oven three loaves of bread and three loaves of cake were baked in the morning. The large apple pudding, known as a "pan-dowdy," was also put in in the morning. The bread and cake were taken out when fully baked, the pudding being left in. Four hours before dinner the sirloin of beef was put in to be roasted; and at the proper time before serving, vegetables and macaroni were baked in this oven.

The lamp used with the "Aladdin" Cooker was the common "entry lamp" which is commonly used to light the hall, fitted with what is known as the "Sun" burner. The lamp used with the dry oven was a lamp commonly used with kerosene stoves, with a wick six inches wide. About one quart of oil was used during the day, a little more the night before in preparing the soup. The soup was prepared in the "Aladdin" Cooker the night before; the carcass of a turkey which had been roasted in the dry oven for the previous dinner was placed in a jar and simmered all night.

These are certainly somewhat remarkable results. The secret, of course, is in the non-heat-conducting wall of each cooker, that of the so-called "Aladdin" Cooker being pine wood and sawdust two inches thick; that of the "Aladdin" dry oven being two sheets of galvanized sheet-iron with an interspace of two inches filled with carbonate of magnesia. In the oven which I used the interspace was only one-and-one-half inches, and it was not completely filled; I therefore wasted a good deal of heat.



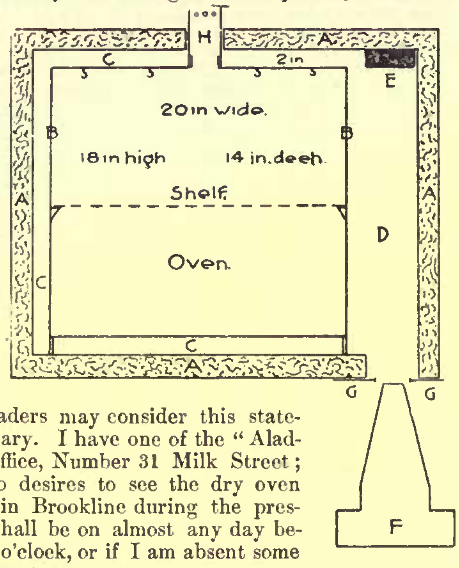
We find that meat cooked rather slowly at 300° Fahrenheit is in the best condition. We find that bread baked slowly at 300° Fahrenheit is very much better, has more flavor, is sweeter and lighter than when the same dough is baked in the ordinary oven at a much greater degree of heat.

The general verdict in regard to the food prepared in these two ovens is that it is more juicy, has a better flavor, and is in every way better than when cooked in the ordinary way. This is especially true of game and birds, simmered slowly.

I have made a small addition to the kitchen of my summer house ly constructing a small room in which there is a brick table, on one end of which will be built a broiler or grill to be worked with

[1] A, one-half to one inch pine; B, one to one and one-half inch sawdust; C, copper lining; D, copper cover, one-half inch, filled with sawdust; E, copper duct and cylinder, in which water circulates, heated by F lamp; G, tin guard to prevent radiation and to protect wood from heat; I, faucet; H, one or more pots, jars or tin pails; W, water in circulation outside the pot or jars; W', water level.

charcoal; at the other end a place for two cookers. I can see no reason for making use of the cooking-stove during the ensuing summer unless it may be occasionally for heating an extra quantity of water. It is my intention to alter my winter kitchen in Brookline by adding thereto a suitable place for this apparatus, depending upon the furnace to keep the kitchen warm.



The attention required by this apparatus, after the food has been prepared and placed in it, is only that needed to take the dishes out at the proper time; while *in* the ovens absolutely no attention is called for.

I fear that your readers may consider this statement somewhat visionary. I have one of the "Aladdin" Cookers at my office, Number 31 Milk Street; and any architect who desires to see the dry oven may call at my house in Brookline during the present month, where I shall be on almost any day between five and seven o'clock, or if I am absent some one will show the apparatus.

I believe this apparatus has great use; that it will promote economy and prevent dyspepsia.

I have stated to some of my friends that the epitaph which may be placed on my monument will be that "He taught the American people how to stew."

I trust that these statements may interest your readers and may lead to improvement in cooking-apparatus with a view to saving heat, by which so many kitchens are made intolerable, especially in the summer.

I can see no reason why the devices adopted in these two movable ovens should not be applied to permanent ovens built into the house and so prepared that ordinary lamps may be used in connection with them, in place of the wasteful consumption of coal now so much to be deplored. If such permanent ovens were thus constructed in connection with the chimneys of a house, the last objection would be removed; the vapors from the consumption of the oil in the lamp would pass up the chimney-flue, although there would, of course, be no smoke. Moreover, if any one fears the least danger from leaving a kerosene lamp burning all night, the chamber for holding the lamp might be made in such a way that even if any accident occurred no harm could happen. It is in this way that I shall arrange for the permanent adoption of this apparatus in my own family.

I have referred to these inventions in cooking as my own. So they are, in one sense. I invented them, but there is nothing new under the sun. It had seemed incredible to me that so simple a principle as that of preventing the radiation of heat by making the outer walls of a portable oven or stove of non-conducting material, should have been overlooked. After I had published the mode of constructing the "Aladdin" Cooker, I received a copy of a pamphlet on penny dinners which are furnished to school children in New-Castle-upon-Tyne, under the supervision of the Rev. W. More Ede; and there I found a description of a German invention which Mr. Ede had made use of, corresponding almost exactly to my own idea, only in this case the apparatus was a fixture of a large capacity heated by gas. I borrowed the idea from the Norwegian cooking-box, adding the circulation of the water and the lamp.

In regard to the second invention of the non-conducting wall in connection with dry heat, I concluded to apply for a patent in order that it might be introduced more rapidly; and then I found that the identical invention had been made and patented by a Mr. W. Goddard, in 1831, only he derived his heat from a small charcoal furnace. Of course, this patent has expired, and the device is now public property. The fact is that inventions that have heretofore been made, but which were impracticable, are now subject to use by the application of kerosene oil or cheap gas in place of a solid fuel.

But again, both these inventions are crude. A professional stove-maker could doubtless very much improve the construction of the oven by giving special direction to the current of heat. In my simple device the heat of the upper chamber is greater than that of the lower; the heat of the end next the lamp is greater than that at the other end. The average heat is easily carried to 300°. The variation of heat is rather a convenience than otherwise, as my cook has found out. In another oven on the same principle I have raised the heat to 450° with a Florence lamp carrying a four-inch wick.

Again, when I cooked twenty-five to thirty pounds of food for my Whist Club dinner the percentage of waste of fuel was something enormous, although the cost was less than six cents. All that I utilized was the heat taken from the top of the chimney; the potential of the oil must be vastly greater. When one considers that a cube of coal of a size that would pass through the rim of a quarter-of-a-dollar would drive a ton of cargo with its proportion of the weight of a steamship two miles on the ocean, one begins to realize the enormous waste of fuel in cooking and in the work of the household. I think the proportion of kerosene oil to thirty pounds of food ought not to be more than one cent's worth, and I do not believe it will be more than that when practical stove-makers have taken up these crude ideas of my own and have developed them as fully as they may be. I will, therefore, set as the objective point or standard for inventors: to improve this apparatus so as to use a quantity not exceeding one cent's worth of kerosene oil for thoroughly cooking the daily food for a family of ten persons. This will be considered as visionary as the statement which I made in 1882, that the introduction of the system of ensilage for feeding cattle would alter the equation in this way — "where it had been one cow to four acres it might become four cows to one acre." I have lately received a statement from Mr. George H. Gilbert, of Richland, N. Y., giving facts: he states that he fed sixty-five cows this last autumn and winter for seven months on the product of corn-stalks raised on fifteen acres of corn land, giving them, at the same time, not exceeding five cent's worth of grain per day, raised on other parts of his farm; he intends next winter to make beef on ensilage only, carrying the corn for the silo in the field up to a rather more mature growth than is corn when it is cut as a green growth only.

The more one investigates the food question in this country the more apparent it becomes that the waste of food and fuel is greater than that of any other element of subsistence.

My final conclusion is that if the average daily ration of the people were reduced to its most wholesome, nutritious and digestible quantity, but yet in as great variety as that now consumed or wasted, the difference accumulated would be equal to the entire annual sum of the additions to the capital of the country now made in any one year. In other words, the waste of food and fuel to-day is equal to the entire net profit upon the product of the United States. This may be readily believed when the equation is stated as follows:

Population 60,000,000 at five cents a day each, *wasted*, comes to $1,095,000,000. Deduct on infants $95,000,000. Net loss from bad cooking and waste, *one thousand million dollars' worth of food and fuel per year.*

EDWARD ATKINSON.

[1] The concentration of heat is greatest at the top; perhaps it would be better to make the top of the outer oven thicker, so as to check radiation more. A A A A, double metal wall filled-in with a non-conductor, two or three inches, carbonate of magnesia or infusorial earth (*not* asbestos, as it is a good conductor of heat). The door of the outer oven should be made the same as the wall, two to three inches thick. B B, sheet-iron or copper oven. C C C, circulation of hot air around all sides of inner oven. D, flue to receive hot air. E, brick or iron, to protect sheet-metal from heat. F, square cooking-lamp, or common "Sun Burner" — lamp such as is used for lighting. G G, slides to close the lower opening, more or less — cut in two parts, so that one or two lamps may be used at one time, the rest of the opening being closed if only one is used. H, ventilator to the cooking or inner oven. Can be made on orders by Kenrick Brothers, Brookline, Mass.

THE DESIGN FOR THE DETROIT POST-OFFICE.

BOSTON, MASS., May 10, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In the Boston *Post* of this morning in a "special" from Washington, the Supervising Architect of the Treasury is represented as saying that a recent article in your periodical was instigated by myself. Such an accusation is as injurious to you as to me, and though personally — to my loss — unknown to you, I am certain you will take an early opportunity to repel it.

Very respectfully,

CHARLES EDWARD PARKER.

[WE could not have supposed that any one who had before his eyes the design for the Detroit Post-Office could imagine that we needed any "instigation" to speak as we did last week of that piece of official eccentricity, and so it never occurred to us that any one could imagine that we were pulling wires for any one. Neither Mr. Parker nor any individual outside of this office asked us to speak as we did. We are exceedingly sorry for Mr. Bell as an individual that our remarks had to be unpalatable, but we cannot extend the same sympathy to Mr. Bell the Supervising Architect. Our object — the only one we had in view — will have been attained if we have sufficiently attracted attention to this important branch of the public service to bring it about that in future the designs for Government buildings shall not be prepared in the Government office, and that henceforward the duties of Mr. Bell or his successor shall be purely administrative. To properly perform the functions of a good clerk-of-works toward all the buildings the United States is now building will take all the time, skill, and energy of a very capable Supervising Architect." — EDS. AM. ARCHITECT.]

CHICAGO, May 9, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I have become aware that there was an adverse smile against Mr. Bell's design for the new Detroit Post-Office, but until to-day I have only been able to see the smile of derision. Now you have given it to us, and I cannot resist the Unitarian right to ask you *why* is it an "abomination," "inexcusable misemployment of time," "absolutely discouraging," etc., etc.? Watching the architectural gyrations as they have occurred in this country for the last twenty years, I venture the assertion that, if you ask, through your valuable paper, the opinion of the profession throughout the country you will find a fair majority that will call it good, and I know of no way in which you can more thoroughly aid in the advancement of the architects than by setting a "pro" and "con" ball rolling on this very design, as it now has taken the plainest of adverse criticism. I believe that men whose opinions are valuable will disagree with you.

I write for two reasons: 1st, to voice an honest conviction that the design named is infinitely superior to many of the post-offices of the

country. 2d, In the hope that you, in your able way, will answer Why? and that the most able of the adverse critics will come to your aid.

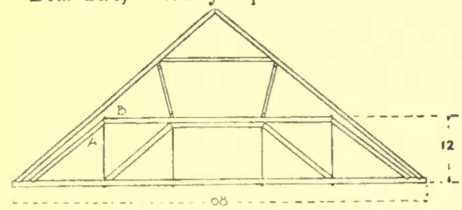
Yours respectfully,
E. S. Jenison, *Architect.*

[To the first of our correspondent's "reasons" we will say that the Detroit design *may* be "superior to many of the post-offices in the country," and yet for all that be a most lamentably inferior work. In reply to the second, we will quote what Mr. Bell, as reported by the Detroit *Evening Journal*, himself says of the design: "What style of architecture," asks the reporter, in his simplicity, "do you call the building?" "Cosmopolitan or American, if you please," replies Mr. Bell. "I have endeavored to combine the serene dignity of Greek architecture with the Gothic, at the same time applying the vigorous lines of the English, the artistic feeling and grace of the French, the refinement of the Italian, and the systemative adaptation of the German schools." In the face of this statement it seems impossible to offer our correspondent a satisfactory criticism until it is explained how this difficult programme is satisfied by the resultant design. We confess to being puzzled whether to perceive in the pepper-castor top which crowns the building, an example of "Greek serenity" or of "Italian refinement." The inserted columbiads, crowned by conical shells evidently too large for the bore of the ordnance supporting them, being suggestive of force, may be taken as some of the "vigorous lines of the English." The irregular and lop-sided arcuation, more suggestive of the progress of a wounded canker-worm than anything, may be an "adaptation of the German schools," while "French grace" to season the dish to the taste can possibly be discovered in different parts of the design. If a "fair majority" of the architects will say that this design is *good*, we will give up the necessary space in our columns to publishing their names, and a confession that we and the supporters of our opinion, if we have any, are an unfair minority. — Eds. American Architect.]

A ROOF TRUSS.

To the Editors of the American Architect: —

Dear Sirs, — Will you please inform me if this sketch of truss and roof framing represents a good and safe method of trussing, and also will you explain how much must be depended on in regard to the strength obtained at joints by the butting together of the wooden members A and B providing there is a washer and nut for iron rod to pass through, and greatly oblige



Constant Reader.

[The sketch shows a tolerably safe and strong truss, if the members are large enough for their work; but equal strength might be obtained with less material, in a somewhat different form. The butting together of the timbers A and B we should not consider a proper framing. A strong iron strap should be put on each side of the joint, and bolted through. — Eds. American Architect.]

NOTES AND CLIPPINGS

A Costly Tomb. — The late Baron du Menil of Brussels left, as he supposed, a fortune of only a few thousand dollars, and directed that, after paying some small legacies, all the remainder should be spent on his tomb. It has since been discovered that, unknowingly, he had a fortune of more than $600,000, and the courts have been asked to decide whether all that must be spent on a mausoleum. — *Exchange.*

Practical Method of thawing Earth. — It is often necessary to make excavations for pipes in very cold weather, under which conditions the operation is difficult. The trouble due to frost can only be remedied by thawing out the surface. The *Elettricita* says that quicklime has been tried with success. The surface where the excavation is to begin is covered with alternate layers of lime and snow. The lime becomes slaked, and heats the soil so effectually that, after ten or fifteen hours it can be dug up with the greatest ease, even where the cold is excessive. It goes without saying that where there is no snow, water can be used. This makes the process a little more complicated, but it is just as efficacious. As in the generality of cases urgency exists, the digging up of pipes being necessitated by some case of repairs, this method is restricted in its application to those cases in which the delay of a day or a night is not inadmissible. — *Scientific American.*

TRADE SURVEYS

The fact that building operations in New York, Philadelphia, Pittsburgh, Chicago, and three or four other cities in the far Northwest, to say nothing of cities in the South, show an increase of from 25 to 30 per cent, in estimated amounts to be invested, so far this year, over last, is the strongest argument that could be adduced to show that the present industrial situation is healthy. The trade statistics in many other branches exhibit a fair increase. In New York City the volume invested so far this year is about double the amount given for the same time in 1885. In Philadelphia the increase in building activity as compared to two years ago is between 60 and 70 per cent. In Pittsburgh it is double. In Chicago it is over 50 per cent. In Minneapolis, St. Paul, Omaha, and in some of the smaller rising towns of the Northwest, comparisons can be made only in the multiples. The same is true of some Southern cities and towns. The activity which, for some years past, has been largely confined to the larger cities is now extending to the smaller towns throughout the interior. Many of the architects of larger practice, especially in the West, have, within the past thirty days, closed contracts for a great deal of small house-building work in the smaller towns. This is particularly true in Indiana, Illinois and Iowa. A great deal of small house-work is about being undertaken in Michigan and Wisconsin. Missouri is also feeling a fair share of the activity, and so is Kentucky. In spots in the South real-estate speculation is leading the way for a great deal of building activity which is sure to follow. Much more property has been purchased at high prices in the South and West than can be profitably built upon or disposed of at an early day. Prominent real-estate authorities interested in the increasing activity in real estate think that the improvement is legitimate, and will hold, and is simply the levelling-up process which they now profess to have forseen for some time. They argue that the practical absorption of the desirable agricultural lands of the West by railroad companies, syndicates, and individual purchasers is the cause, in a great measure, of the present general improvement of land outside of these interests. Be this as it may, it appears that an improving tendency has set in which will enable tax assessors to mark up the value of the real estate of the country. It is true that agricultural territory is in growing demand where agricultural products can find a near market. A great deal of agricultural territory is still comparatively valueless because of remoteness from markets, but at the same time these lands are now under inquiry, or observation, by prospective purchasers, who contemplate extensive operations for speculative purposes in the future. The price of bread-stuffs does not encourage the expansion of the agricultural area as much or as rapidly as real-estate speculators or operators would be glad to see. Yet a great deal of heavy land buying is being quietly done, and it is done in view of what the buyers believe will be a general appreciation of real estate. These operators believe that there are many influences at work to lift the price of land onto a permanently higher basis. Among these influences may be mentioned the cobwebbing of the country by railroad tracks, the increase in immigration, made up largely as it is of farming labor; the increase in the volume of circulating medium which, according to the latest treasury report amounts to some $68,000,000 since July 1. The increasing tendency of population in the Eastern sections of the United States to find Southern and Western opportunities, and finally the general increase in manufacturing activity and in the enlarging consumptive requirements of the whole people. In other words, the land speculators recognize that the era of cheap land is about over, and that we are entering upon, or soon will enter upon an era of advancing real estate values which will make property a far more valuable article of merchandise than the products of timber or iron ore. The views entertained by so many who have recently been giving quiet expression to them may be somewhat chimerical, and it may be possible that the available agricultural territory is sufficiently extensive to provide for the actual necessities of the new comers for years to come, but the speculators think otherwise, and they are taking time by the forelock, making heavy purchases, not only of mineral and timbered territory, but of agricultural territory as well. They are buying up at low prices to hold for the incoming and oncoming millions, and will charge them a liberal margin for their stewardship.

In the lumber trade values are higher than last year, and the actual demand for consumption in the country at large is fully as large. Taking this in connection with the shortage, which is not denied, manufacturers and dealers are quietly edging prices up a little, among small buyers particularly. Demand for lumber in all the leading markets along the Atlantic coast is quite active. Complaints over interstate freight-rates are disappearing.

The receipts of yellow-pine, spruce, hemlock, and of all kinds of hardwood have been increasing under the improving demand for building requirements. Oak, plain and quartered, cherry, mahogany, and walnut, are all in better demand than a week or two ago, on account of the probability entertained by many of an actual scarcity later in the season. The supply of brick will be abundantly large, and all the new machinery that has been set since last season has had its season's capacity sold. The brick manufacturers have avoided or settled strikes. And while the cost of brick-making is slightly greater in several cities this year than last, the manufacturers expect to equalize on some of the finer qualities. Ample preparations have been made for an increased output of stone in all the leading desirable qualities. The latest reports from marble and granite sources indicate that some of the heaviest contracts placed for years have been recently secured. The stocks of slate are light, but the quarries are working full time, and there will be no delay in filling all contracts made. The iron and steel makers are profiting by a little dulness. The furnace capacity is running to its utmost limits. Perhaps 25 per cent of the bar-iron capacity will be in need of business before the close of this month. Nails are selling in Eastern markets at $2.10 to $2.25. The demand for steel nails is growing. All kinds of steel are in very heavy demand to meet the requirements by the new shop capacity, which has been forced into existence by the heavier demands of the past year or two.

American bessemer has declined as much as $1, and a good many brands of forge and foundry iron have dropped as much. Bar-iron is holding its own. Plate, skelp, and tank, and all kinds of rolled steel are firm in price, as competition has already done its best. There is nothing new in steel rails. No fresh orders have been given for foreign material. English markets are still strong under the heavy American and Colonial demand, and the improvement will last that market for some time to come. At this time the anthracite-coal managers are awaiting the developments of the threatened strike, there are over 1,000,000 tons of anthracite above ground, and the producers say, privately, they are able to endure a six weeks' or two months' strike without loss, in fact, to their advantage. The buying-interests both East and West, have been holding back, as usual, anticipating a break in prices. A strike will be worth several million dollars to the anthracite producers. The bituminous-coal interests are now booking their orders as fast as they can be entered, and in a week or two the season's production will be practically sold. It is very safe to say that at no time has the demand for machinery and motive power been as great as at present. The car-works, spike-works, bridge-works, locomotive-works, and the manufacturers of engine and boiler capacity have booked a great deal of business since May 1, and the daily inquiries which are arriving go far to show that the demand will be a continuous one throughout the summer. The agricultural demand for small stationary engines is quite a feature. Machinery for machine-shops is in demand to the full extent of machinery-making capacity. The best-known machinery-makers in the country are full of work, which will last from one month to four. Agents who are soliciting orders, state that the competition is very close, and that there is a race between the manufacturers of machinery to secure the best shop and mill appliances, so that they can do better and cheaper work than others. One of two orders were given out recently for the projected cotton-seed oil-mills in the South. Sixteen are to be built by one company, eight this year and eight next. The demand for machinery has stimulated a number of new enterprises which will take root, some of them in the dangerous ground of the South, and some in the risky locations of the West. The railroad companies in both sections are intending to pursue a policy of supplying their own requirements as far as possible, and some of the new rolling-mills projected, and many of the new industrial establishments heard about are projected and supported by the enterprise of prominent stock-holders in the railroads which will be the best customers of the new concerns.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. No. 595

MAY 21, 1887.

Entered at the Post-Office at Boston as second-class matter.

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MAYOR HEWITT, of New York, who frequently propounds some new idea, which, moreover, is generally good, has made public a suggestion which will be heartily seconded by thousands of the quiet, sensible Americans who have succeeded in making this country what it is, in spite of the howling quacks from every clime who try to advertise themselves by attempts to interrupt its progress. Not long ago, the wife of a Knight of Labor wrote a touching letter to the editor of one of the daily papers, begging him to interfere with his great influence to prevent a strike from being ordered. Her husband, she said, had steady work at satisfactory wages, and they were living comfortably, and laying up something for the next winter. If the Executive Committee of the District Assembly should order a strike, as it was reported they intended to do, to show "sympathy" with some other deluded Assembly, or on some other pretext, he would be compelled to give up his work, perhaps through the busy season, and his poor family must look forward to a winter of privation and misery. She knew by sad experience what this meant, and in the extremity of her helplessness before the might of the "colossal organization," she appealed to the only power that she knew to be capable of opposing it. A few days later, a member, not of the "colossal organization," but of the class which that organization systematically hounds and persecutes, wrote to Mayor Hewitt, calling in also his aid against its unrelenting malice. The writer was a plasterer, standing, as he said, "at the head of his profession," and with a wife and five little children dependent on him for the means of existence. Three years ago, being, apparently, a man of considerable energy, and disposed to better his condition, he agreed to a proposition to work by the hour instead of by the day. For this violation of its principles, he was fined fifty dollars by the Plasterers' Society. It is hardly necessary to say that working-men with large families to support do not usually have fifty dollars about them, and he could not pay his fine. The Society thereupon commenced the well-known persecutions by which working-men are terrified into silence and submission. A watch was set upon the delinquent and if he found employment anywhere, notice was given to his employer to discharge him, under threat of the usual penalties. After going in this way from place to place, he had an opportunity to speak with the "walking-delegate" who had come to deprive him again of his living. The delegate informed him that he had imperative orders to "knock him off" wherever he found him, but said that if he would appear before the Society leaders that evening he might make an arrangement with them. He went to them accordingly, and was told that by the payment of eighteen dollars and a half he might obtain a "permit" to work. Not having eighteen dollars and a half, any more than the previous fifty, he could not buy a permit to earn his living, and the next morning his employer discharged him, without assigning any reason. Not knowing what else to do, the victim of his inability to pay to the "colossal organization" the money which the organization prevented him from earning appealed to the Mayor, as a "defender of the rights of American citizens," to tell him what to do next. Mr. Hewitt replied in his usual sensible way, saying that he had received many other letters of the same sort, and, while conspiracies to take away a man's business, like the one described, were illegal and indefensible, and subjected those guilty of them to the payment of damages, he understood how impracticable it was for a poor working-man to obtain damages by process of law. He suggested, therefore, that an association might be formed in New York for the purpose of defending "the rights of honest men who are refused the opportunity to earn their own living," and promised to co-operate with any citizens who might think with him that the occasion was one needing "prompt and earnest action.".

BY the courtesy of Senator Hoar, of Massachusetts, we are favored with a copy of the bill introduced by him last year in the United States Senate for the establishment of a National Art Commission. The bill proposes that the President shall appoint a Commission of fourteen persons, four of whom shall be eminent sculptors, four eminent painters, three eminent architects, and three selected from other employments for their knowledge and good taste in art, whose duty it shall be "to report upon the character and value of such plans of public buildings, monuments or works of art as shall be referred to them by either House of Congress, or by the Joint Committee on the Library, and, when so authorized by Congress, to select designs offered by competitors for works of art ordered by Congress, and to render such other service as may from time to time be required of them by Congress." The Secretary of the Commission, and a member of it, is to be the Architect of the Capitol, *ex-officio*, so that the architects will equal in number the painters and sculptors. It is proposed that the members shall be appointed for three years, and serve without pay, but their expenses shall be reimbursed when they meet at Washington, as they are expected to do once a year. The bill is now before the Committee on the Library, and, if reported favorably, may very probably pass, as is certainly very desirable. To our mind, the appointment of a Commission like the one proposed is a step far better suited to the character and circumstances of our country than the establishment of a Ministry of Fine Arts, which is sometimes advocated. With us anything like an official art is impossible. Even if we had a single great national academy, where all our painters and sculptors were educated by the same methods and under the same masters, we have no prefects, or local representatives of the central administration, to impose a uniform style on all works of art done for the public; and the mixture, or perhaps rivalry, of State and local schools of painting, sculpture and architecture, brought periodically into contact and comparison before a representative Commission at Washington, as the works of Greek artists were before the elected judges at Olympia, could not fail of the happiest results for American art. Hitherto, our artists have suffered by seeing too little of each other's works. Who, for instance, among the New York painters and sculptors, knows anything about the beautiful carving in wood that is done in Cincinnati; or what artist west of the Niagara River could name over the works of George Fuller, of Massachusetts, or Mr. Inness, of New York? Yet the Cincinnati carving and the Eastern painting are alike things for Americans to be proud of, and each of them would be better still for a mutual acquaintance among their authors. The work which such a Commission as Mr. Hoar's bill proposes would have to do, would consist to a great extent in the introduction, so to speak, of all our best artists to each other. The honor of membership in it could be sought with so much eagerness as to constitute the appointment one of those high professional rewards which we need here so much, and its decision would command attention and respect all over the country. The New York painter who found a Chicago picture preferred to his by such a jury would be likely, much to his own advantage, to take the first opportunity of visiting Chicago to find out in what the superiority of the local school consisted;

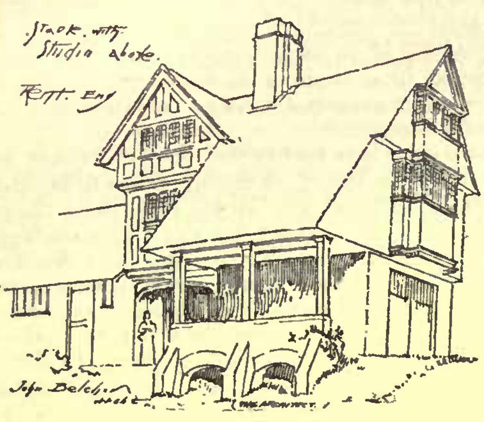
and the Texan sculptor, defeated by a Boston rival before judges of such standing, would soon come to Boston to share in the advantages of life-schools and antique models which had once given his rival the victory. Apart from its use to artists and art, the Commission would render an immense service to the public. It is quite unnecessary to reproach our legislators with the want of discrimination in art which appears in the decorations of the Capitol at Washington. We venture to say, much as we dislike some of the pictures and frescos in the building, that no large legislative body in the world, under the same circumstances, would have made a better selection. To the lawyers and editors who represent the people in Washington or London or Paris or Berlin the comparative merits of pictures or statues are as unintelligible as the refinements of the Roman law would be to a painter. Most of them are quite aware of this, and would gladly hand over to an expert committee the task of deciding upon matters of public art, just as a painter would put on a lawyer the responsibility of defending him in a suit, if there were any such committee within reach. In France there is always some such authority to make the decision, but in England and this country there has hitherto been none, and commissions for the public pictures or statues have consequently gone to the artists who had the prettiest ringlets, or gave the pleasantest dinner-parties, or presented the most formidable list of recommendations.

THE *Builder* speaks of a recent auction sale of land on Broadway, New York, at which about one hundred and forty-two dollars per square foot were paid; and says that "the value of land in New York does not appear to be so high as in the city of London, where land on Cornhill and its neighborhood has been sold for two hundred dollars per square foot." We should be sorry to see New York lose its preëminence as the most valuable area of land on earth, and hasten to suggest that a comparison between Broadway, above Wall Street, and Cornhill in London, is hardly fair. Cornhill, as the central point from which the greatest English corporations are managed, corresponds rather to Wall Street than to Broadway; but although the business of Cornhill is the direction of two-thirds of the marine traffic of the world, and of the inland commerce of a large part of four continents, that of Wall Street is practically confined to the internal affairs of a single nation; a lot on Wall Street is said to have been sold some years ago for three hundred dollars a square foot, and would probably bring much more now. If we are not mistaken, this is the highest price ever paid for land anywhere. It is true that the area of excessively valuable territory in London is larger than in New York, but to make up for this the price of real estate in the parts of New York remote from the business quarter are much higher than in the corresponding portions of London. It is not very long since a lot on the corner of Fifth Avenue and Forty-second Street, then surrounded on all sides by private dwellings, brought sixty-five dollars a square foot, and for many years a fair exchange for a lot on the most fashionable streets has been a sum which would at least cover the lot with silver fifty-cent pieces. At still greater distances from the centre of business the difference is even more striking. Lots in the outer zone of London are very commonly rented on long building-leases, so that nothing more than the unexpired term of the lease is sold; but freehold land can occasionally be had, and brings, so far as our observation goes, generally a good deal less, rather than more, than a dollar a square foot, while land in New York, more than nine miles from Wall Street, has recently brought five and one-half dollars a foot at auction.

NOTHING astonishes an American abroad more than the backwardness of foreigners in adopting the little household conveniences which with us are matters almost of necessity. On the Continent, where people seem to live generally in the streets, and to have well-founded objections to staying in their houses any more than they can help, it is not so surprising that great pains should not be taken to render domestic life easy and convenient; but in England, the country, above all others, of beautiful and happy homes, one is often distressed to see the labor habitually expended upon work which in this country would be done almost automatically by some sort of ingenious appliance. We remember once going over the Belgravian mansion of Sir George Grey, ex-viceroy of India, and finding the kitchen in this aristocratic abode furnished with an enormous open fireplace, in which swung a crane, with pot-hooks and hangers, the whole, with the addition of a brick oven, forming the only cooking apparatus of the establishment; and every traveller can give plenty of illustrations of the discomforts of English houses. Even where American devices are transported across the water, they are received with suspicion, and are regarded as eccentric novelties for years after they have come into universal use with us. The last of these inventions to be introduced to the British public seems to be the well-known electric gas-lighting apparatus. Few houses, even of very modest pretensions, would now be built in or near any of our Northern cities without this indispensable feature; but it appears to gain ground very slowly in England. The *Builder* says, rather doubtfully, after describing the system, by which the gas can either be turned-on, lighted, or turned-off, by pushing a button, with the automatic burner, or turned-on by hand, and lighted by a pull at a pendent chain, that the apparatus appears to it "rather a pleasing toy than a serious convenience"; going on to explain that "it is hardly worth while to have a special electric mechanism merely to light the gas." This sounds very funny to people who never think of using matches or tapers to light the gas in their houses, and who would not on any account go back to that old-fashioned and dangerous practice. Even if the *Builder* thinks it of no advantage to be able to light the gas in the room by pulling a chain, or touching a button, instead of feeling in the dark on the mantel for the match-box, at the peril of upsetting the bric-à-brac behind which it lies concealed, and then succeeding in reaching the key and turning on the gas just in time to have the red-hot remnant of the match drop into one's sleeve, while the gas, unlighted, pours into the room, it must, we should imagine, acknowledge that there is practical utility in an apparatus by which the gas in any room can be lighted from any other. In thousands of American houses the entrance-halls and vestibules are now lighted by the touch of a button in the rooms above, so that a ring at night, or an unusual noise below stairs, is immediately answered by lighting up the rooms, as a preliminary to a descent to see what is the matter; while in hundreds more the lanterns in the carriage porch, or along the driveway, are lighted and extinguished from the house in the same manner. With us the use of this simple and effective system is rapidly extending. We know a house where not only the gas-lights but the fires are kindled and extinguished by the touch of a button; and the best of all systems of burglar alarm is that under which the house-breaker, on crawling through the basement windows, instead of frightening the family out of their wits by sounding a bell and displaying a sign in the bedrooms, to the effect that ferocious criminals have arrived in the kitchen, sets in motion an apparatus which begins by suddenly illuminating with great brilliancy the place in which he had intended to do his deeds of darkness, at the same time deafening him by ringing an immense gong close to his head until the attention of the police is attracted to the place; the whole of the little drama going on without interrupting the slumbers of the unconscious master of the house in his room above.

SEVERAL of the foreign papers quote from the *Bulletin Ceramique* the following recipe for making a cement suitable for repairing stone. The cement consists of two preparations, a solid and a liquid. The solid portion is composed of two parts by weight of oxide of zinc, two parts of marble dust, one part of pounded earthenware or brick dust, and ochre enough to color the whole to the shade desired. These substances are mixed dry, and well stirred together. The liquid is made by dissolving zinc filings in commercial muriatic acid until it will dissolve no more, and adding to the solution one-sixth as much, by weight, of chloride of ammonium as there is of zinc in the solution. This is stirred in, and the mixture diluted with two-thirds its volume of water. When wanted for use, ten pounds of the powder are mixed with three pints of the liquid, forming a paste which solidifies very quickly, and soon becomes very hard. After forty-eight hours' setting, it will resist a tensile strain of about one hundred and fifty pounds to the square inch, and at the end of six months, its resistance to crushing is equal to that of most granites. It is best not to use the cement in too thick masses. Where the cavity to be filled is more than an inch deep, it is best to fill it nearly to the surface with pieces of stone in cement, well fitted in, and finish with the zinc cement.

DECORATIVE GLASS.[1]



THE remarks I have the honor to lay before you, ladies and gentlemen, this evening, are descriptive of a beautiful and fairy-like art. I call it fairy-like, not only because of the delicacy and beauty of the material used, but because of the simplicity of its manipulation, and the rapidity with which its most attractive creations are effected. Glass is transparent as water, and, like the drops and jets of water, threads of it are crystallized into jewelled forms by the action of the air; and, again, light, brittle and destructible as glass vessels are, they are yet capable of outlasting many, if not most, of the substances out of which vessels can be made for our use.

Before proceeding to discuss the manipulation of our material, it will be necessary to show how it is made. Glass, says the late Professor Barff,[2] appears to be a mixture of silicates. The material is principally sand, with an alkaline substance, either a salt of soda or potash and lime; though in some kinds of glass, oxide of lead takes the place of lime. The scientific name for sand, or, rather, its principal constituent, is silica. This compound oxide of silicon, or silicic acid, when brought into contact with bodies of an opposite character, under suitable conditions unites with them and forms a salt. Now, silicic acid, at the ordinary temperature of the air, has no action whatever on carbonate of soda, but when heated sufficiently, the action becomes vigorous. When sand is mixed with oxide of lead (common litharge) they unite, forming a compound similar to that produced by the silica united with the soda. In one case a soda glass is formed, in the other a lead glass; the former is made with coarser or finer sand, according to what is to be made from it, such as common bottles, crown, sheet or plate glass. The latter kind is called flint glass, and is used for the finer works of the glass-blower — glasses, table decanters and glasses, and imitation jewels. It is more brilliant, colorless and transparent; it is also considerably heavier than window-glass.

In putting together the materials for glass-making of the finer kind, it is of great importance that the sand should be as free as possible from impurities. The Venetian furnaces are said to have been supplied from the coast of Syria, where the sand had been famed for its excellence from the days of ancient Rome. The sand now used for flint glass is brought from Alum Bay, in the Isle of Wight, and from Fontainebleau, in the latter case at high prices. The principal impurity found in common sand is some form of oxide of iron, which produces a green color, and the presence of iron is neutralized by adding black oxide of manganese. This reduces the oxide to the state of peroxide. Peroxide produces a yellow hue, and only to a slight degree. It is by no means easy to adjust the quantity of black oxide of manganese to the amount of iron in the sand, and if in excess, a purple color is produced. Much of the window-glass of ninety years ago is of a purple hue on this account. If rightly proportioned to the iron in the sand, no appreciable color is imparted by this substance. I believe that at present arsenic is considered, for various reasons, an equally effective and more manageable agent for this purpose than black oxide of manganese. The proportions quoted by Professor Barff for window-glass materials are: Sand, 4; sulphate of soda, 2; lime, about $\frac{3}{4}$ to 1, with a small quantity of carbon as charcoal. For flint glass: Sand, 3; red lead, 2 to $2\frac{1}{4}$; carbonate of potash, $1\frac{1}{2}$ to $1\frac{3}{8}$, with a little nitre, or saltpetre, as an oxidizing agent. The analysis of Pompeian glass gives: Sand, 4; soda, 1; lime, $\frac{1}{2}$ (about); and a small quantity of alumina. Here the proportion of soda seems much less, and lead does not enter into the mixture. Different makers vary these proportions, and have mixtures of their own. If soda is in excess there is apt to remain a certain amount of it not properly reduced, and it is gradually dissolved by the action of the weather, making those holes which we see on the outside of some old window-glass. Sometimes we see on the surface a delicate film, which, seen in a certain light, is opalescent. This is also noticeable in glass that has been long buried, from the action of salts in the superincumbent earth, and shows that the due proportion of the materials has not been observed, and a perfect union has not resulted. It would be very desirable that careful experiments should be made by chemists, so as to save glass-founders from errors of this kind, as far as they can be made avoidable.

The materials are partially heated together, and are then called fritt. The fritt is afterwards put into glass-pots, made of fire-clay, in the furnace, where they are gradually fused, and fresh fritt is added till the glass is in a doughy state, not too liquid, in which condition it is known as metal. The pots for window-glass are uncovered, and the fire passes over them. Those for flint glass are covered over, leaving an opening in front for the use of the blower. A scum which rises to the surface is removed by iron ladles. A small quantity of broken glass is thrown in at intervals to complete the fusion and purify the metal.

Various colors are imparted to glass by the mixture of metallic oxides: red, by copper, as well as green and blue, according to the nature of the oxide: blue by cobalt. A beautiful pink is produced by oxide of gold, and, if used in large quantities, a fine red. Oxide of iron produces either green or yellow. Yellow, of various depths, is also produced by silver, but not by melting it with the metal. Oxide of silver is mixed with chalk, or some similar substance, and laid on the glass when cold, and it is then heated to a dull red, and the yellow stain is pale or deep, according to the quantity of oxide used. Red produced by oxide of gold, and copper-red are both coated over clear glass heated and blown into sheets. Purple and black are produced by black oxide of manganese. There are, however, many varieties of hue which are produced in different factories, some, probably, by accidents of the melting. It is of these materials that painted glass is made, but, as glass painting belongs rather to the painter's art, I shall not attempt any discussion of it here. As we see it in old church windows, it is the very romance of mediæval painting, and its special claims depend on the mellowness and beauty of the glass prepared for it.

Besides glass colored in the metal, gold-leaf can be laid on glass, etched and coated over with a thin film of glass. Glasses colored, but more or less opaque, are used in small dies on walls and vaults, for another kind of painting called mosaic. Light is reflected by this kind of painting, but it is transmitted in many hues by painting on colored glass in windows. The Whitefriars furnaces turn out a peculiar kind of glass, opaque, and having the look of unglazed porcelain, on which designs are drawn and painted with enamel colors, and these paintings are put into muffles (small kilns, which can be gradually heated at will), and burnt in as in window painting. Like mosaic work, it is a kind of decoration applicable to wall-surfaces, in which it can be imbedded. I notice it here because this kind of glass is the result of a peculiar process. It may be produced by breaking up glass of the color required, and fusing it over again. What sort of intensity of heat, or period of time may be required in its fusion, I do not know, but it may be produced in another way. I shall have to advert presently to the process of annealing, or the very gradual cooling which glass goes through before it is fit for use. Now it seems that glass, when it leaves the furnace, takes a long time for its particles to arrange themselves. If glass vessels have not been properly annealed, they are extremely brittle; they crack easily if hot water is poured into them — more easily the thicker the glass is; the inside heats and expands before the heat has reached the outside. Thin glass is less brittle. But if thick glass has been carefully annealed, it is less liable to such accidents. If, on the other hand, glass is kept at too high a temperature in the annealing furnace and for too long a time, it loses its transparency and becomes crystalline in texture. This process is called devitrification. A kind of porcelain was at one time made of glass in this state, and went by the name of Réaumur's porcelain. Devitrified glass, as it can stand the weather, if painted and if the incorporation of the enamel colors used upon it were thoroughly understood, might, I suppose, be used not only for internal but for external wall-decoration as well. As far as I can learn, such a complete incorporation of enamel ornament on glass of whatever kind has not yet been arrived at, the enamel having a liability to wear off the surface, and the process is perhaps still to be examined by practical chemists. So far, then, as to the composition of the various glasses in use.

Next, as to its manufacture. I have compared it to the crystallization of pure water by the action of the air, for it is the breath of the workman that puts life and beauty into the lumps of soft metal that he draws out of the pot. There are several distinct operations in the decorative treatment of glass. It is blown, cast, moulded, stamped and cut in a variety of ways when cold. The oldest and the simplest process is that of making simple bottles and window-glass — which is of various qualities. This is how sheet-glass, for instance, is made: The workman takes an iron blow-pipe, from 5 feet to 6 feet long, and from $\frac{3}{4}$ of an inch to 2 inches in diameter according to the weight of glass he intends to work. He dips this into the glass-pot, gathers by a twisting motion a lump of doughy metal at the end of it. He then blows into it till it swells out into a pear-shape. He then rolls it on a slab of marble or of smooth iron, called a *marver*, so as to keep the shape and thickness he requires. It is then swung from side to side over a pit till it has drawn itself into a length sometimes of fifty to sixty inches, and has assumed the form of a true cylinder. It is again heated in the furnace. The cool end of the tube is stopped with the finger, and the air expanding within the cylinder bursts the heated end. The workman withdraws it, and while hot rolls it round, and with an iron tool brings the burst part to the diameter of the cylinder. The other end is detached from the blow-pipe by drawing a thread of hot glass round the shoulder, and after removing the hot glass, a cold tool causes it to crack all round. The cylinder is scored down its length internally with a diamond, and placed in a flattening kiln; when soft, it is opened out with wooden tools where the line has been scored; it is then flattened out on the smooth floor of the kiln. Glass so

[1] A paper by John Hungerford Pollen, read before the Society of Arts, and published in the *Journal* of the Society.
[2] British Industries, Glass, etc.

flattened is sometimes polished, and is then one kind of plate-glass. Commoner crown glass is made by opening the globe blown by the workman, who then heats it again, and trundles it round till the heated sides of the globe start suddenly round into a great disc, with the thick bull's eye in the middle. These kinds of glass are annealed and cut up for window-glass. Plate-glass is not blown, but is either ladled or poured on an iron table, which has edges to suit the required thickness of the glass. It is then rolled with iron rollers. When cold, two plates are brought into contact with each other, and the two surfaces ground with sand and water. They are finally polished by machinery, a process formerly done by hand.

These may be called elementary operations. Decorative blowing, which is now to be considered, is a more intricate process, for the working of which long training and skill, readiness and confidence, are required. The workman's tools are of the simplest kind. He uses a blow-pipe as described, rough tongs, scissors, with short, broad blades and compasses, to gauge his work as he goes on. He has a marver to roll his metal on, and a chair, of which the arms are horizontal iron rails, on which his blow-pipe, or his pontee, or solid holding-rod, can be revolved by one hand, acting as a rough-and-ready turning-lathe.

Let us see how he makes one of those elegant glasses which I shall speak of as Venetian glasses, because the Venetians made them two or three centuries ago in such endless variety, and they now form the glory of glass collectors. Here, for instance, is a decorated glass such as I have had the great pleasure of seeing made in the glass-house of Messrs. Powell, in Whitefriars. Withdrawing, with the blow-pipe, a small lump of not too liquid glass, the workman blows it into a bulb, and the general shape — convex or conical — is given to it. He then takes a fresh piece of glass to make the stem; sits in his chair and keeps revolving his pontee (holding-rod) with glass at the end on the arms, as if in a turning-lathe. By the use of his tongs he contracts it where he wishes, forming neckings and bosses. If he is working from an original which he wishes to copy, or from a drawing he has prepared, he regulates the measures of his new stem by applying his compass to the drawing and to his work. Glass cools too quickly to allow the modelling of such a stem without reheating the material from time to time. If it has considerable length, he has to keep turning it round in the furnace to avoid its drooping. It is then again brought to the chair, and the lathe action renewed, till this portion of the glass is completed.

Next, an assistant, with a pontee, armed with a dab of hot glass, sticks it to the centre of the bulb, the workman detaches his end of it from his blow-pipe by touching it all round with a wet iron. The pontee, with the bowl of the future glass, is reheated. The operator trims the edges with a pair of scissors, rolls it on the warmer, and shapes it out with his tongs, turning the bowl of the glass round as he does so. The bowl, or body, has then to be detached from the pontee on which it has been kept, the stem heated and the two attached. If the glass has wings or handles of white or colored glass, a small lump of the required metal (as the fused glass is called) is brought by an assistant, the modelled glass being kept at a proper heat. The workman takes a pinch of it with his tongs, draws it out to the thinness he requires, sticks it in its position on the glass, draws it out to a thread or ribbon, forms a loop or loops in it, and brings the end down again to the bowl or stem of the vessel. He pinches this ribbon in at intervals, or thinning it out into a thread, he loops it in and out as he wishes. We see, on some old glasses, the wings, head, claws and feathers of the two-headed Imperial eagle of the German Empire. Many of these devices are highly complicated, and when the rapid rate at which they are necessarily executed, and the lustrous crystalline beauty of the finished vessel and its decorations are considered, there is no violence in the comparison of this beautiful art to the action of the northern wind on the raindrops, and the tender spray of the water-fall. But while these beautiful crystallizations grow dim and disappear when we grasp them, the marvels of the glass-blower's art may outlast the lives of many generations.

I have spoken of clear glass, whether white or colored, but glass vessels were and are still made by the Venetians, and at Whitefriars and elsewhere, in which opaque white glass is inserted, taking variously shaped filigree patterns, twisted, network, and collected into beads or balls, and similar arrangements in great variety. I shall show you presently in the lantern some examples of this from the South Kensington Museum. This white goes by the Italian name of *latticinio*, or milky. The vessels made in this material are usually striped, that is, made of bands of clear glass, and of glass in which these white lines, variously twisted, are contained. How is this made?

Opaque white, or enamelled white glass, as it is sometimes called, is made by the addition of oxide of tin, and the metal is then drawn out into little sticks called canes, as in these specimens from Whitefriars. To make these into Venetian *latticinio* or filigree, a number of short pieces of cane are arranged at intervals round a jar and kept, perhaps, in place by a little sand at the bottom, or accommodated to slight flutings inside the vase. A lump of heated glass is then held by the blower just in the middle of the vase. For some time he merely so holds it that it may bring the little canes up to the requisite heat, so that when touched by the heated mass they may adhere to it. He then blows and expands the heated glass till it touches and takes up the white canes. The mass is then heated, drawn out and rolled on the marver till the canes are flattened and thoroughly incorporated into the sides of the clear glass in the middle; the whole is then coated over with clear glass. This lump is then pulled out and shortened, one man holds it with one hand on the arm of his chair, while another gradually draws it out and twists it. During this process he varies these twists by holding the glass in at intervals, and other clever turns of the hand. The white lines may run round a central white line, inserted previously into the clear glass, or round a colored one.

When these filigree canes have been twisted and drawn out to the thickness of a quarter of an inch or so, short lengths, perhaps of a series of these compound canes of different patterns, are themselves incorporated into a fresh centre of clear glass, and blown into a globe or a vase, which then has alternate stripes of filigree and clear glass running up its surface or spirally round it. We see dishes and vases in which the white or colored lines cross each other, in what we may call engine-turned reticulations. One method of this operation is said to be by blowing a globe of glass out of a piece in which the white has been twisted spirally, and in one direction. The lower half is then pushed up inside the upper, and a reverse set of spiral lines is added, and the glass thus doubled is dealt with to form a vase or dish, but I have never seen this operation performed. Many of the larger glass vases have medallions of colored glass on their shoulders, or round their sides. This is done by laying a lump of heated glass in the place desired, and stamping it at once as if with a seal on sealing wax. Vases are sometimes made with grotesque animals, such as stags, fishes, or birds within them, or else the glasses themselves are in those shapes. These grotesque forms are said to have been intended for the mysterious pharmacy of the alchemist. The visitor to large museums will see an endless variety of these blown, twisted and variegated vessels, dishes, bottles, etc., not to speak of the beautiful chandeliers in which the branches are interspersed with stems bearing colored flowers and crimped leaves. Chandeliers and complicated looking-glass frames are made up of many different parts, the making of which is simple enough when we examine these compositions in detail.

I must now advert to a mixture of fragments of colored glasses welded in the metal state and veined in the manner of marbles, out of which ornamental glass vessels are blown; this is called *schmelz*. Glass is also made to take up minute pieces of gold-leaf or of copper, which are incorporated into the mass, and forms a costly-looking material, called *avanturine*. Many of the decorative additions to Venetian vases, etc., are made in avanturine glass. Another product of combined pieces of glass consists of sections of cane arranged as stars and flowers, and bedded in clear metal, forming a mosaic. Paper-weights and other masses of this kind of glass have long been made by the glass-makers of Murano for the European markets.

The processes we have been considering are properly the work of glass-blowers, but glass vases have been made in Venice, and still more in Germany and other northern countries, who borrowed the art of glass-making from the Venetians, with heraldry and other ornament painted on the surfaces with enamel. The colors are made up with some metallic flux, or with glass reduced to powder, which melts, when exposed to a moderate heat, sufficient to heat the surface of the vessel, and becomes incorporated with it.

Cylindrical vases, decorated with enamelled paintings, made in Bohemia and in various parts of Germany are to be seen in most collections. Other methods of decorating glass are by moulding, cutting and engraving. Glass-moulding is done by blowing the glass into a mould. Moulds are now made of metal, but I believe it is a question whether in ancient glass wood was used, or wood coated with some composition. In any case, glass is blown into the mould till it reaches the sides and receives the pattern or design prepared for it. The mould, which is hinged in two or more parts, is opened as soon as the glass cools, and the vessel retains its fire polish.

Cutting is performed by applying the glass vessel to the edges of a disc of sandstone with a sharp edge, revolved by a treadle, and on which sand and water are made to trickle. The cuttings are next smoothed on a disc of slate or some fine stone, and are finally polished on a grinder of cork with putty made of some product of lead. Facets, stars, and other simple patterns are made by these means. For more delicate work a copper disc is employed, not larger than a shilling, or smaller still, and finally, the graver.

Cutting of a fine kind, in elegant designs, is found on many of the Venetian vessels of the sixteenth and seventeenth centuries. There are vases in the Kensington Museum of German-Venetian workmanship, with figures on the surface, etched, apparently, with a diamond, and of the utmost fineness and delicacy.

Venetian seventeenth-century looking-glasses are found with figures cut on the backs, which are left rough and show like dead silver. When certain designs, such as scrolls, foliage, and the like are polished as well, and in all their parts they add an extraordinary delicacy and lustre to the glass or vessel on which we find them, and impart to it some of the charm which belongs to cut and polished rock crystal. So far, then, as to the general operations of the art now under discussion.

Considering, next, the knowledge of chemistry and the connection of that science with the making of glass itself, one would be inclined, at first sight, to say that glass can only be the product of a scientific age. As a science, chemistry is of comparatively modern growth. Yet glass-making has a far-reaching history. In many respects the composition of the material, and certainly its artistic treatment, has been carried farther by the ancients than by ourselves. The

antiquity of glass is proved both by paintings in the ancient tombs of Egypt of the fourth dynasty between three thousand and four thousand years old, and by specimens still sound and entire, which have been recovered from them and can be seen in the British and other museums. Whether Egypt is the country of its actual invention is disputed. The Romans claimed it as an accidental discovery of Phœnician traders. As a fact, the art was carried from Egypt to Syria; to Sicily; round the Mediterranean, to Asiatic Greece; and finally, to Rome. Alexandria continued for a long period a principal seat of the manufacture. Tyre was another. It was established on Monte Cœlio in Rome and elsewhere in Italy in the time of the early Cæsars, and the beautiful colored drinking-cups then made or imported were highly valued by them. A story is told of a maker, who, when the Emperor Tiberius spoke of the fragility of his wares, dashed down, or let us suppose let fall, a glass cup, which was uninjured by the action. It is conceivable that the process of making unbreakable glass, as now practised, may have been known in those days.

Among the productions of Egyptian glass-makers must be reckoned that of artificial precious stones. Some of them were of an astonishing size: A statue of Serapis thirteen feet high, of emerald; an emerald given to a Pharoah by a Babylonian king, six feet by four feet, in this case of Asiatic manufacture. Some large pieces survived those ancient times and are still surviving in church treasuries, which were believed to be colossal emeralds in the Middle Ages, and were highly valued accordingly. We hear of a table made of a single emerald, found by the Arab conquerors of Spain.[1] The colors of such slabs or blocks of this material as are now extant, are of extraordinary richness and beauty.

The Kensington Museum possesses a number of dishes, vases, bottles, and fragments of green, amber, amber-brown, sapphire-blue, and schmelz of great beauty. The canes, of which the mixed-glass vases contain sections, are twisted and rolled together in the manner described as regards Venetian glass, but far surpass such examples as I have seen. They can scarcely be represented by photography. The light must be seen through them and on them in order to the full appreciation of their splendor.

The Romans were luxurious and costly in the decoration of their houses, especially of their dining-rooms, in which the important business of the day was carried on. They devoted much splendor to the ceilings of these rooms, which were panelled and coffered in var ous ways, and the enclosed spaces were gilded and inlaid, among other materials, with little decorative mouldings of colored glasses. There are fragments of sapphire-blue moulded-glass decoration at Kensington which seem to have been made for this purpose.

Among the more costly glass productions of ancient times we must reckon dishes and vases, cut, like cameos, from colored glasses coated with opaque white glass, the parts not required for the design being cut down to the translucent ground. The Portland vase in the British Museum is a beautiful example. A vase of two colors of glass, opalescent, the designs in high relief, was exhibited at Kensington some years ago by a member of the Rothschild family. There is a fragment of a figure, the drapery only, modelled in very low relief on blue ground at Kensington. The drapery shows that the entire figure must have been nearly a foot high.

Sefer Nameh, an Oriental traveller, who wrote a journal between 1035 and 1042, speaks of green glass made in the suburbs of Cairo in his day and of furnaces at Tripoli and elsewhere on the Syrian coast. Of Oriental glass, the most noteworthy examples that can be referred to are the lamps formerly hung in the Arab mosques of Cairo and other cities. Indeed, few more beautiful examples of decorative glass can be seen anywhere. They are in the form of bowls on flat stands with wide funnel-shaped necks and loops on the shoulders for suspension. They appear to have been made of common glass. In the structure of it you observe specks and bubbles, and they have a horny look, perhaps from their age and the constant presence of oil about them. The decoration consists of bands of red or blue enamel color, and legends written in fine Arabic characters, clear glass on the colored bands and *vice versa.* These legends express pious ejaculations, quotations from the Koran, and the names of reigning princes or donors. There are several examples of these lamps at Kensington, and some of small size of other shapes. A large collection has been made at Cairo, and some of those examples were lent at one time for exhibition at Kensington. The glass houses of Alexandria, Tyre, and other Mediterranean cities, turned out these beautiful lamps during the fourteenth and fifteenth centuries. But they were made also in Venice to order during the same period. The Persians were the chief customers. Persian workmen were possessed of extraordinary skill in repairing broken glass, but were not successful in making these lamps for themselves. Persian glass vases and *mille fiori* work of great beauty will be seen in the South Kensington Museum.

The ancient Roman industries and the best artists of the fourth century were transplanted bodily by Constantine to his new capital Constantinople, and it was from the Greeks of the Eastern Empire that the glass-makers' art was recovered in the Middle Ages, when Italy emerged from the ruin of barbarous invasions. The Venetian islands offered a refuge for such refugees from the mainland as they could support. It is claimed by Venetian annalists, and I incline to believe justly, that this glass industry has been preserved by the Republic, even from Roman times. However that may be, it seems to be from the Greek artists who were received in Venice after the sack of Constantinople, at the beginning of the thirteenth century, that the finer treatment of glass took its renewed traditions. This industry grew and prospered. Two centuries later, the Eastern Empire was overthrown, and a more general immigration of artists and learned men took place into Western Europe. It is from this time that the Venetians encouraged the manufacture not only of beads and imitation jewels, but fine glasses and vases. The island of Murano became the chief seat of the glass-houses of the Republic. Severe laws were passed forbidding the emigration of skilled workmen, and a sort of home rule was granted to the little island, and many social privileges were conferred on the leading members of the guild, or craft. We have already spoken of the kind of work produced. When the fashion of cut-glass came in during the last century, Venetian glass-making declined.

German princes and governments took great pains during the sixteenth and seventeenth centuries to introduce Venetian glass-work within their own borders. Workmen were enticed and smuggled into these States, and some fine blown-glass vessels were made in various countries. It has been maintained that the fine Venetian pieces on which the Imperial eagle and other German insignia are worked must be of German origin, but as glass was made for half the princes and noblemen of Europe in Venice — in many cases to special order, in others as diplomatic presents from the Government, we ought, I believe, to credit examples of this kind to the makers of Murano. It is true, however, that in Germany and Flanders, Venetian vases and glasses, more or less decorated, were produced, but the very finest examples were probably imported. As regards German seventeenth-century glass, heraldry and inscriptions in enamel painting, or engraving, form its chief decoration.

The Government of Louis XIV took as much pains to smuggle glass-makers into France as it did for lace-making and other highly skilled industries. Fine examples of cut-glass chandeliers, looking-glasses, blown glasses, and other old French glasswork are still to be met with.

As regards our own country, the making of common window-glass was active from the seventh century. By the middle of the sixteenth it was established at Crutched Friars. In 1673, the Duke of Buckingham brought Venetian workman over, and settled them in Lambeth. Their principal work was making mirrors of cast or flatted glass, with slightly bevelled edges, and carriage windows. Such bevelled glass was used for glazing the royal palaces and costly houses. Panes of it (of the seventeenth and early eighteenth centuries) can be seen now in the sashes of Wren's portion of Hampton Court. Wine bottles, to judge from an old one in our possession, were squat bulbous quarts, with the family crest stamped on the shoulder, wine being imported and bottled at home. The glass industry was for a time protected by State bounties.

The last century saw the end of many declining local industries. Twenty years of war ruined a vast number of porcelain, glass, and other establishments. England had fine potteries still, and exported these wares to the north of Europe and to the south. It is to be met with in Germany and Holland and in Spain, but decorated glass was confined to cut table glass, chandeliers, and other work, of which cutting is the chief ornament. Such chandeliers were to be seen in all theatres, halls, and ball-rooms. The material was clear and lustrous, the prismatic pendants and hanging chains brilliant and effective, though not equal to the earlier productions of France. The brilliancy of these chandeliers goes far to redeem their weight and troublesomeness in cleaning. So, too, of table glass, but its great weight is a serious disadvantage, and its decoration is merely mechanical.

Great pains have been taken for some years past by our London and other manufacturers both with the crystalline and brilliant equality of their flint glass, and in the manufacture of colored glasses. A great impulse for the latter was given by the revival in France, and still more, and even passionately, in England, of mediæval art. Church restorations at the expense of the Government in the former country and by private persons in our own led to the cultivation of glass-painting, almost a lost art till of recent years. Willement and Gerente are names honorably connected with that movement and the method of attaining the splendid hues of old window-glass has been carefully studied. Commoner, inferior and less crystalline glass is a better vehicle for color than flint glass, perhaps a more effective material for Venetian blown work.

Some years ago Sir Henry Layard, Sir William Drake and others came forward to try and put new life into the glass-works of Murano. They found funds, looked up workmen who still represented the old traditions, and so, under the energetic lead of Dr. Salviati, the decorative glass-blowing of Venice has been revivified. All the old methods and many of the elaborate designs of the old artists have been put in practice. These Venetian processes have been carefully followed by some of our own leading glass-makers.

Within the last few years some very beautiful cameo glass-cutting has been executed, principally, I believe, by artists in the Stourbridge works. Some very successful examples were shown at Kensington in the Health Exhibition in 1884. There evidently is a hopeful future for this special branch of sculpture.

This brings me round to the point from which I started, the art as we see it now in our factories at home and in Venice. Both there and here the aim is the same, to restore the old methods and work

[1] "*Ancient and Modern Furniture,*" lxii.

them out with the old skill. Modern chemical knowledge ought to put us at an advantage over our ancestors as regards methods and compounds, and to make it clear whether modern furnace-heating is better or worse than the former practice. But that rule-of-thumb which comes from long and unbroken experience is not to be recovered easily or soon. Seeing what accuracy of eye, what delicacy of touch, what grace in the action of the hand, are required for the finer productions of the blowing-iron, it may be doubted whether the Italian has not a natural advantage over our northern workers. Joints and muscles matured under a southern sun are more supple and elastic than the hardier and stronger arms of the colder latitudes. But the feeling and spirit that inspires the artist emanate not from his fingers, but from his mind. I have no desire to enter on the thorny path of abstract principles regarding this or other arts. Too much has been said on that head, and said a great deal too often. I prefer to speak of the art of glass-making, so pure, so fresh, so luminous in its creations as a tradition, with some three thousand years or thereabouts at its back. Though the Venetians throw themselves into the Greek traditions as they came down to them, I have little doubt but that they pushed the art of blowing and manipulating fused glass beyond any perfection attained by the Greeks of Byzantium, perhaps by the ancient Greeks; but of that we have not sufficient ground for judging. They do not, however, seem to me to have come near the ancients in compounding those precious materials imitative of emerald and other costly crystals, out of which were made the cups and bowls to which I have already referred. I think this is a kind of perfection from which the Venetians and we ourselves are still far removed. So we still are from such sculpture as we see in the Portland vase.

Now for a word or two as to our modern English-Venetian and as to modern Venice-Venetian blown-work. Much of it is of great beauty, and where decorations of colored glass and avanturine are employed it is skilfully done. But comparing it with sixteenth-century work, we are struck by a glaring and over-showy look about it, and an absence of refinement. What we call good taste in art is a delicate and instinctive appreciation of the suitableness, the propriety and fitness of decoration, which accord with the natural limitations of the material employed. A glass or a vase is set off by a certain amount of ornamental detail of colored glass or of other decoration. But the color should be sparingly used and should not be of many, very generally not of two colors. The colored parts are like jewelry on a lady's neck. We must not ask her to suspend it from her nose as well as her ears, or load her with many colored varieties. Each addition will detract from the value of those already hung. Avanturine, again, is a gold glass, or passes for it. This material, so valuable in appearance, must not be, as it too often is, in such proportions as to lose its decorative value. As to cut-glass, chandeliers and table glass so decorated have a splendor of their own. But what are we to say to a huge throne, a sort of *tour de force* made of vast masses of moulded and polished glass, or to fountains such as I have seen in some of our vast international exhibitions? I doubt whether any absolute novelties are in store for us in this branch of human industry. But of lost ground we have still much to recover. The bane of modern artistic industries is the popular demand for a novelty, even though the novelty should be monstrous.

Shall we ever make again those masses of splendid material, jewel-like in color, containing something like crystalline light within them, and those colors, not only the primary and secondary colors of the Middle Ages, which indeed we already have, but those tertiary colors which the ancients contrived to reach?

Every generation has some qualities of mind which are its own, every nation has its natural aptitudes and aspirations. By these the traditions of art, and more especially of artistic industries, take a definite character if genuinely carried out. We read it on the surface of the production of ages and of nations, and when we see it we say this or that piece of work is of such and such a time and country. If we are faithful to the laws which trained the artists of older days, we shall acquire confidence and become artists in our turn. Our work will be thorough and have new life in it, though our ways will be old ways still.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE ROTCH TRAVELLING-SCHOLARSHIP DRAWINGS. — PLATES XLIX., L., LI.

[Issued only with the Imperial Edition.]

WHOLESALE WAREHOUSE FOR JOHN R. LIONBERGER, ESQ., ST. LOUIS, MO. MESSRS. SHEPLEY, RUTAN & COOLIDGE, ARCHITECTS, BROOKLINE, MASS.

HOUSE OF MR. ZENAS CRANE, JR. MESSRS. FULLER & WHEELER, ARCHITECTS, ALBANY, N. Y.

DWELLING-HOUSES ON SEVENTY-FOURTH AND SEVENTY-FIFTH STREETS, NEW YORK, N. Y. MESSRS. LAMB & RICH, ARCHITECTS, NEW YORK, N. Y.

PAVILION OF THE CHATEAU DE BLOIS, FRANCE.

BOOKS AND PAPERS

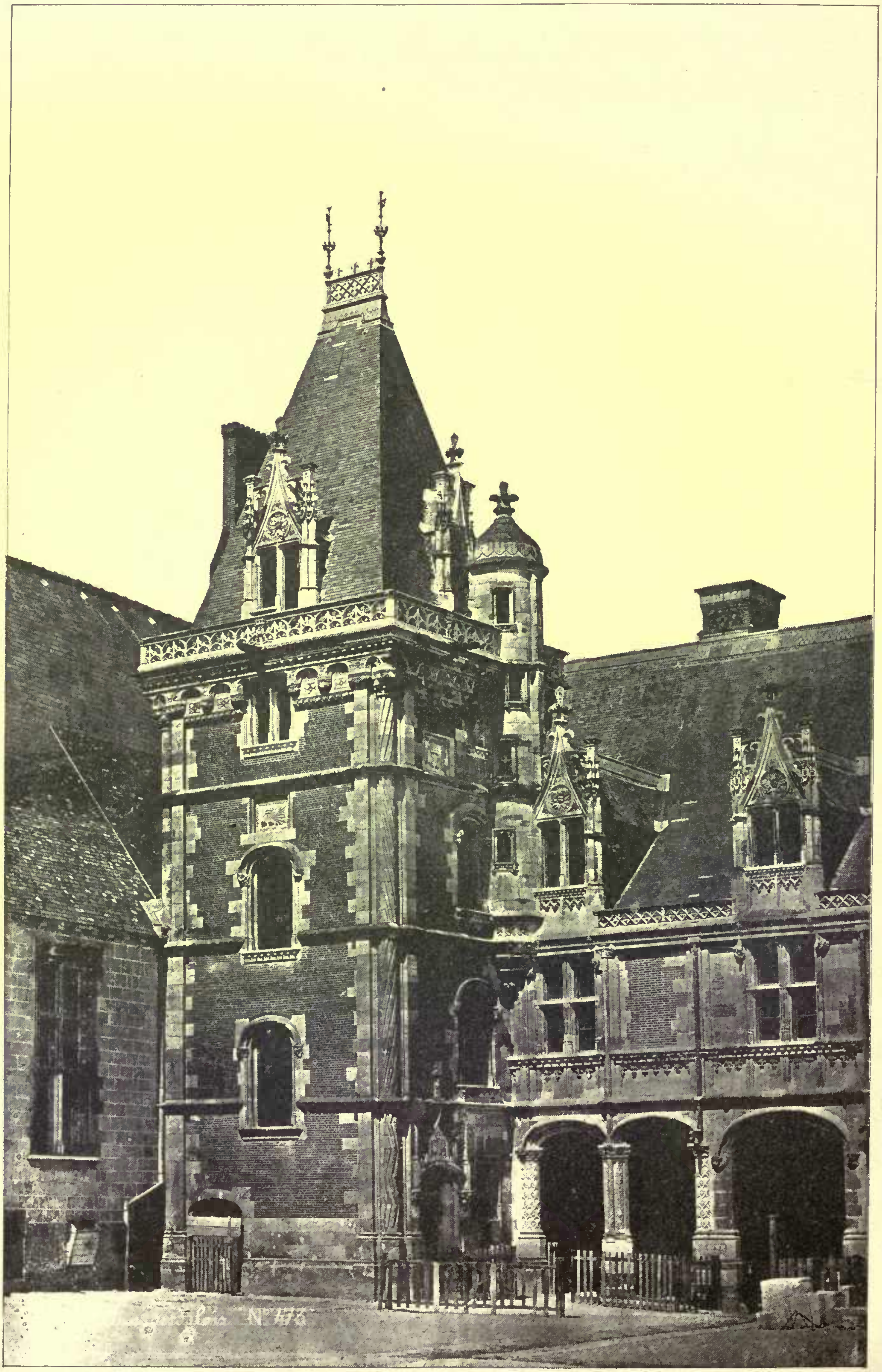
TO any one who is at all familiar with the masterpieces of Dutch art, or who has ever had even a passing interest in the art of etching, it seems almost incredible that so powerful a painter and so indefatigable an etcher as Rembrandt should have been held in very slight consideration as a master during his lifetime, and should have taken his present rank in the history of painting only within quite recent years. It seems so natural to admire the strong, eloquent canvasses which are now found in every gallery in Europe, and Rembrandt is so incontestibly not only the father of all etchers, but an artist who has seldom been equalled and never been excelled by any of his successors, that we can only wonder at the indifference which was such a constant annoyance to Rembrandt all of his life.

According to M. Emile Michel,[1] the greatest painter of Holland was born at Leyden, July 15. 1607, in a house situated within view of the city walls, and on the banks of one of the branches of the Rhine, from which, following the example of his father, he took his name of Van Rijn. He was the fifth son of a miller, Harmen Gerritszoon, and his father being in very comfortable circumstances, Rembrandt was put to the best schools and received the rudiments of an education intended to fit him to take part in the literary movement which was then beginning to be felt in Holland, especially in the University town of Leyden. But Rembrandt had no ambition to become a scholar. His special talents manifested themselves in so marked a manner that his father wisely took him out of school, which in those days meant little more than Latin and some abstruse theorems in geometry or philosophy, and left him free to follow the bent of his own genius. At the age of thirteen, he was placed under the direction of Jacob van Swanenburch, an artist of considerable local renown, but of little real merit, to judge by the few of his paintings still in existence. Three years later he went to Amsterdam, and entered the studio of P. Lastman, who appears to have been almost the only artist who exercised any decided influence on the young painter. It has been thought that from his last master Rembrandt drew his manner of massing the lights and shadows and contrasting strong tones. Though young as he was, he had learned to think for himself, or rather to study nature, until his thoughts became as spontaneous and natural as the warm sunlight which so captivated his boyish heart. He was only a lad of sixteen when he left Amsterdam and returned to his native town to study his art in his own manner, and nature was art to him in a way it had never been to any painter before him.

His first picture which bears a date was made in 1627, a "St. Paul in Prison." It shows careful study and an attempt at *chiaro scuro* treatment, but Rembrandt had not yet become himself as we understand him now. We find his life at this time was passed very quietly in and about Leyden, painting a little, studying a great deal and especially perfecting himself in etching. It is not known when or how he began with this medium, but it evidently came to him as naturally as painting, and a portrait of his mother etched in 1627 shows him to have been already past-master in an art that was at that time but little known. Rembrandt's etchings are never lacking in interest. He was always at his best in handling the needle and in the sharp black and white studies of even his earliest years he is untrammeled by any of the formalisms or cold Italian traditions which at that time still hampered the artists of the Dutch school. Indeed, it may almost be questioned whether Rembrandt would have developed in the lines he did in painting had he not been continually practised in etching, an art which almost obliged him to mass his shadows, to seek the essentials in a figure or a composition, to draw exactly and to make each stroke tell. He etched his mother, all his family, his friends, the family mill, landscapes, animals, everything that came under his observation, but in portraiture it was especially his own face that he chose for a subject, etching and painting it in all poses and under all lights; not as an amusement, for Rembrandt was too serious to play with his art, but as earnest study. He continued all his life to make portraits of himself — there are no less than fifty in the various European museums — and one can trace him through all the changes of his life, from adolescence to disappointed old age, and the series is full of pathos to one who considers the hopes deferred or abandoned which made his heart so sick at times.

In 1630, he returned to Amsterdam, and fixed himself there for life. By this time he had acquired more than a local reputation, and his first two years' work in the capital won for him a position among the best artists of the proud Dutch city. He was cited as the fashionable portrait painter — a doubtful compliment, perhaps — and when the celebrated Doctor Tulp wished to perpetuate the souvenir

[1] "*Les Artistes Célèbres: Rembrandt,*" par Emile Michel. Paris: Librarie de l'Art, J. Rouam, Editeur.



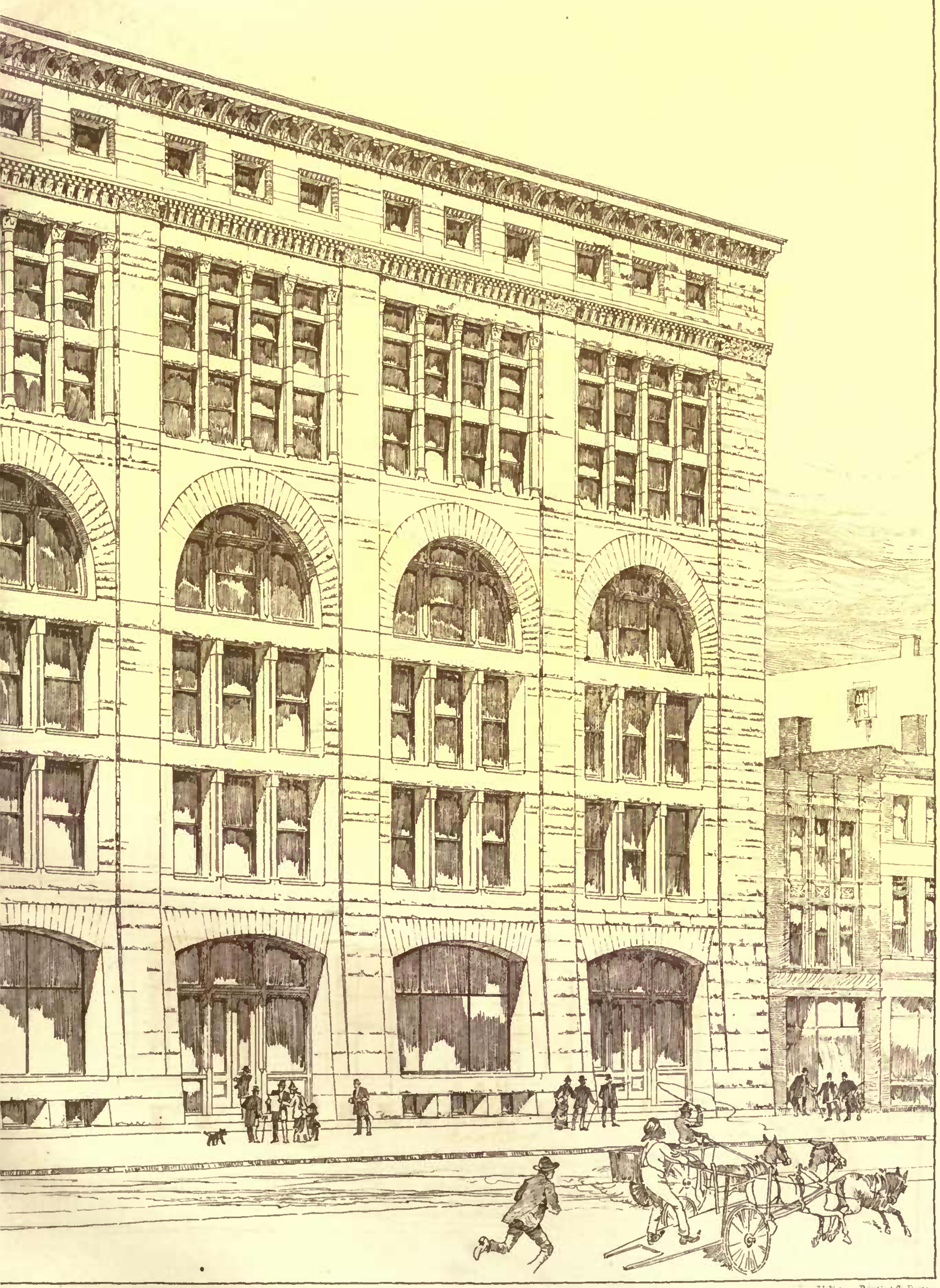
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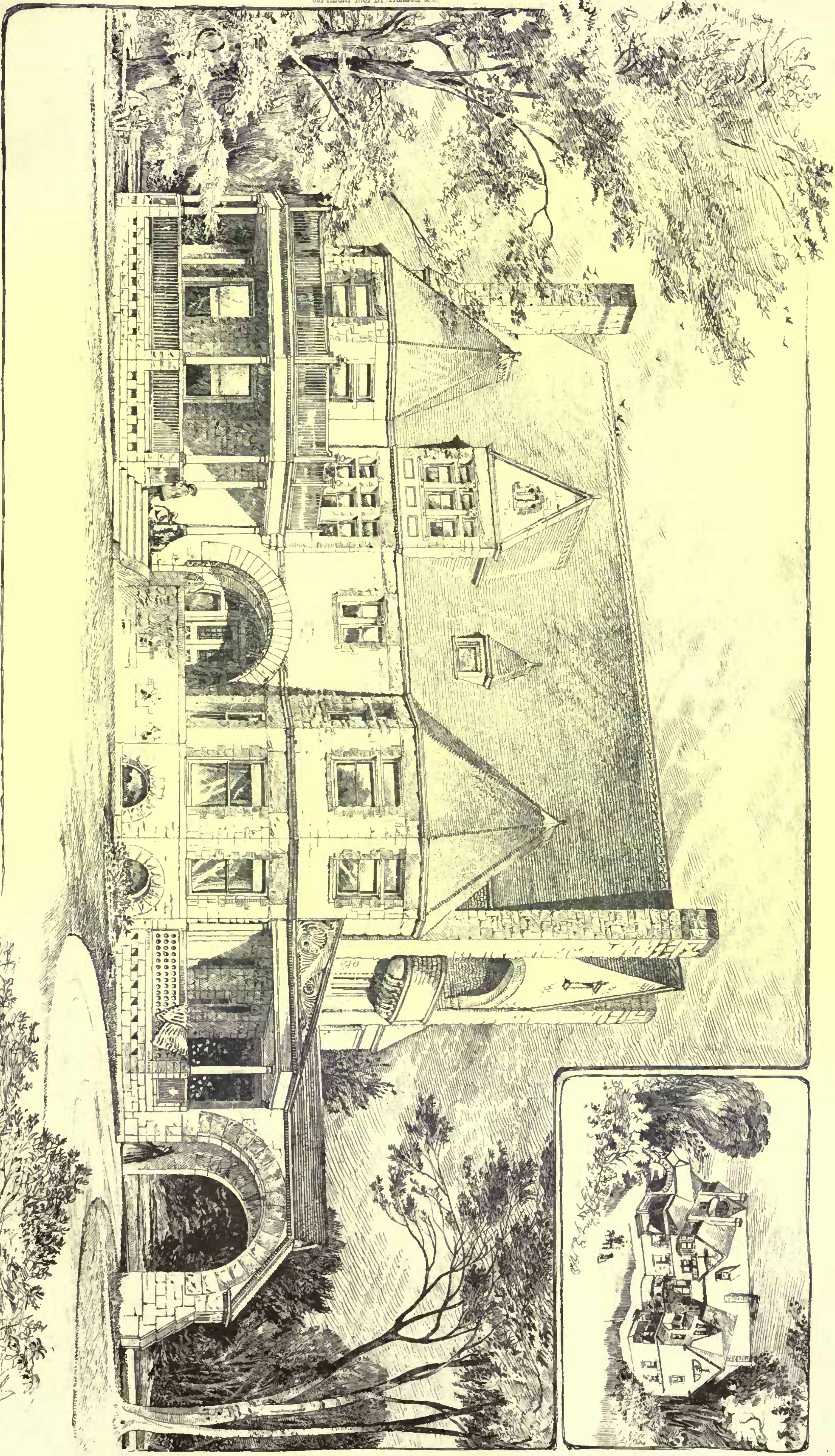




∴ CORNER · SEVENTY-FOURTH · ST ·
AND TENTH · AVENUE ∴

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of his lectures before the guild of surgeons, Rembrandt was naturally chosen as the artist. The picture he produced, the famous "Lesson in Anatomy," is too well known to require any description. No one has ever looked at it without being struck with the wonderful ease with which so difficult a subject was handled, as well as with the manner in which the whole composition is centered so strongly on the hand which is performing the operation; and looking at it, one will almost instinctively draw forward, examine closely, and be infused with the earnest intent feeling which is so strongly marked on the eight faces grouped about the dissecting-table.

Rembrandt's later life may be divided into two periods, one terminating with the death of his dearly beloved wife, Saskia, during which time he at first gained in the esteem of the public and was honored by commissions of every kind including even a large historical painting, "the Peace of Munster," now in the Rotterdam museum. But even before his wife died he had ceased to be the artist *à la mode*. The matter-of-fact, straight-forward, Dutch mind had grown tired of his dark-toned paintings, and his so-called "Night Watch" painted in 1642, the year of his wife's death, though the master's largest and most celebrated work, was received very coldly and was indeed so little liked by the company of arquebusiers for whom it was painted that some of the members even refused to pay for the picture and wished to employ another artist. Thenceforth Rembrandt had always to struggle against coldness and public neglect, and as he had never been a careful manager his life seemed to grow sadder and sadder year by year. He ruined himself by careless disregard of money and reckless indulgence in curiosities and rare bits of bric-à-brac, until all there was left him of a once comfortable property was a mere pittance secured to him by the will of his wife. He lived almost alone with his son Titus and his Mistress Hendrickie Stoffels. He was harassed by creditors, threatened with law-suits, ignored by his fellow artists, at times almost forgotten by the public; but Rembrandt was an artist for art's sake. Through it all his brush and his engraving-needle were ever busy, and as he withdrew from the world he seemed to penetrate the more deeply into the nature which his glorious art enabled him to so fully appreciate. His best work, the "Syndics of the Cloth-makers," was painted when he was homeless, in debt, and over sixty years of age. It shows the wonderful vitality of his art instinct that he should have been able under such adverse circumstances to produce a masterpiece which M. Michel declares to be absolutely correct and perfect in every point. "Amateurs or critics, draughtsmen or colorists, painters seeking for realism or lovers of the ideal, all agree in recognizing this as one of the *chefs-d'œuvre* of painting." The picture is preserved in the Rijks Museum at Amsterdam.

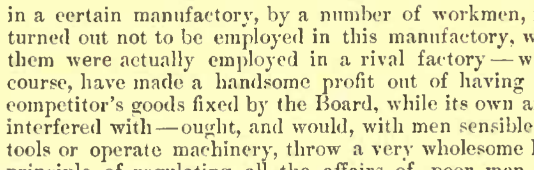
Rembrandt never ceased to work while he could lift a hand. One of his latest etchings is a portrait of himself which is extremely pathetic in its expression of worn-out, exhausted manhood, weary of life. His son died in 1668. Rembrandt himself broken-hearted, forgotten, alone, but still the greatest painter of his age, quietly went to his final rest, the only public notice of his death being the simple mention of his burial in the mortuary register of the Westerkerk at the date of October 8, 1669.

To rightly appreciate the scope and purity of Rembrandt's genius, one must study the galleries of Holland, for although his paintings are scattered all over Europe, his best works and the greater portion of his etchings have never left the city in which they were produced. By comparison with the Dutch artists of his time Rembrandt's genius seems to have been almost spontaneous in its development, a growth without cause or sequence; but when one remembers that Rubens and Van Dyck were his contemporaries in a country as near at hand as Belgium, and when one examines the host of Dutch paintings which make the boast of the Amsterdam and the Hague collections, it is easily seen that great as undoubtedly was his genius, it had its origin in the works of those about him. Rembrandt was the giant of a race of pigmies, the one Dutchman who could think broadly in detail, who could sacrifice parts to the whole if necessary, who did not consider the best portrait to be necessarily that which was painted most accurately; the painter *par excellence* of life and emotion, the only one in all the history of art, Titian alone excepted, who has been able to render the human body with such charm and poetic reality as he infused into the nude figure of Danaë, of the Hermitage collection. As M. Michel well says, "Rembrandt was worthy to become the admiration of our time, for he is the most modern of all the great masters. Through all the fluctuations of taste which have not spared other names his worth has never dimmed, but shines still in all its glory; and the universal accord with which he is honored is the most magnificent homage which can be rendered to a genius so original and so sincere."

WE must confess that we dread nothing so much, in discussion on any branch of social science or political economy, as the mention of "natural laws," or "*laissez faire*," or any of the other formulæ which imply that there is some innate and mysterious tendency on the part of human beings to do what is best for them, which is obstructed and counteracted by the practices of the party happening to hold different views from the person using the expression. Not being at all good at divination, we much prefer finding out what people generally do under given circumstances, and inferring from this what they will do again under similar circumstances, to looking in our own or any one else's moral consciousness to ascertain what they would do in the absence of any circumstances whatever; and our natural aversion to the acquisition of truth by inspiration is somewhat increased by observing that persons more gifted than ourselves, instead of acquiring in this way the same opinions on any given subject, generally develop views of extreme, not to say ferocious, diversity. The small study which we have been able to give to the subject as expounded by philosophers, has taught us that cannibalism, polygamy, robbery, free-trade, confiscation, democracy, absolute monarchy, slavery, anarchy, thrift, improvidence and idleness, are all manifestations of the working of natural laws, which, in the present state of society, are artificially obstructed, and we had arrived at the conclusion after this slight glance into the possibilities of the free operations of such laws, that the methods of obstructing them were not only the most tangible, but the most desirable objects of research.

Fortunately, in this little book,[1] notwithstanding its title, we find only a few pages in which the "natural selfishness" of mankind, or the "universal reign of law," or the "natural and logical fulfilment," of a somewhat hazy prediction; and after those pages are skipped, which is easily done, we come back to a good deal of commonsense — such commonsense as a thoughtful business man can often talk about the social problems of the day, although he does not usually take the trouble to put it in print. It is rather unfortunate that more of those who can think clearly on such subjects, and who have information to communicate in regard to them, do not oftener make their reflections public. They suppose, no doubt, that every one else of average intelligence, except politicians and a certain class of newspaper editors, thinks just as they do; but the less experienced part of the public, being assured a thousand times a day by the demagogues that no one but thieves gorged with ill-gotten wealth objects to the general overturning and redistribution of society, without hearing any contradiction of this opinion, comes, at last, to incline toward a belief in it, and matters are allowed to go on for want of a common understanding between sober and conscientious people, until some great struggle becomes necessary to brush away the delusions cultivated so seduously by those who findl profit in the task, and to open the eyes of their victims, often by a painful process, to the realities of life. More than a hundred years ago David Hume, after describing one of the innumerable assaults mentioned in history, of poverty, ignorance, and stupidity, organized by plausible rascals, upon scattered and unprepared thrift, industry and sense, with the inevitable victory of the latter, observed that of all the disorders that afflict mankind, the tumults of the poor and ignorant were the least to be dreaded — at least by the industrious and well-to-do. In this age he would have added, mindful of the sympathy for the poor and humble which has become so remarkable a feature of modern life, that the distresses in which such agitations involve their ignorant victims are so great that no means should be spared for putting them on their guard against them; and to this end, as it seems to us, the circulation of such striking and unanswerable statements of fact as Mr. Atkinson, for instance, knows how to collect among people who are plied day after day by politicians with the statistics which Mr. Swinton and Mr. George evolve from their highly-deve oped imaginations, is nothing less than a duty. A few well-attested instances, like one which Mr. Wood mentions, where a plausible application was made to a State Board of Arbitration to fix the rate of wages in a certain manufactory, by a number of workmen, most of whom turned out not to be employed in this manufactory, while several of them were actually employed in a rival factory — which would, of course, have made a handsome profit out of having the cost of its competitor's goods fixed by the Board, while its own affairs were not interfered with — ought, and would, with men sensible enough to use tools or operate machinery, throw a very wholesome light upon the principle of regulating all the affairs of poor men by legislation, which is now so readily advocated by politicians; and there are many similar questions on which a similar illumination might be shed.

THE FRENCH *SALON*.


LYONNAIS COFFER. AFTER L'ART

THIS year's show is not so interesting as the last, that of 1886, and in this is just the opposite of the London exhibition. There is an immense amount of good work, both of drawing and painting, there are plenty of good portraits, and an enormous number of charming landscapes; but of subjects new, or novel readings of old ones, the exhibition contains little. The craze for the workman has not died out; not the honest workingman in his home life, or at his post of duty — but the drunken, besotted, brutal laborer at his cups, or handling a dirty pack of cards. This is realism *in extremis*, and however well it may be done, surely there can be but

[1] "*Natural Law in the Business World*," by Henry Wood. Boston: Lee & Shepard. New York: Charles T. Dillingham.

one opinion of the duty of rendering it, and sending it down to posterity as the canker of our times. That the misery of the poor may be a subject to paint all will admit, if only as a wholesome lesson to the rich; but no one is benefitted by an exhibition of brutality, for those who indulge in it never see the pictures.

Last year was a *Salon* of pigs; this one may be called the Boulanger-Hospital exhibition. The worthy minister of war figures everywhere — at the head of his staff, a little distance from his companions *à l'Empereur;* in portraits, great and small, and in sculpture; indeed, I was told by a friend that at one part of the garden a view of five statues and busts of the general can be obtained at one moment. I give the remark for what it is worth, not having had time to search out the truth. Then the hospital pictures, operations, clinical lectures, and sick folk everywhere; doctors, *infirmiers*, students, sisters, and other "helps" with sponges, basins, and instruments — and note, in all, the patient is a *woman*. These pictures strike one as being enlarged from photographs, and are singularly unentertaining to the ordinary observer.

M. Damoye has a charming bit of calm sea on a dull day, which is refreshing to turn to after the flare of M. Clairin's torches round Victor Hugo's bier, set up under the Arc de Triomphe. This is a pretentious picture of the usual mythical kind, and only redeemed by the truth of the red reflections cast upon the cuirassiers. M. Roll's great battle-piece is not an advance; there is a want of color in it, and the movement of the troops rushing off out of line strikes one as being a strange example of the want of discipline. The troops and the officers are marching along as a reserve called up; the battle is waging all about; but the men in the rear seem to be dashing off on their own account — true, it may be for pictorial effect. Mr. Hitchcock's "Tulip Culture" is a clever and original piece of color, and a word of praise ought to be accorded to M. Dupré's cattle. M. Duez has expended a great deal of paint on a large area of canvas; but his grass is metallic, his cattle are wooden, and his moon is a pink wafer. A pathetic picture is M. Pelez's "*Nid de misère*," two poor little waifs cuddled up in a miserable corner, covered over by an old ragged coat. The expression of the sleeping child, worn by hunger and misery, is very true. M. Pille has gone into a new line in a corner of a studio, the artist at his easel with diverse sketches all about.

But the picture which holds its own above all others is M. Benjamin Constant's "Theodora." It is a perfect *tour de force*, and a wondrous example of the painter's cleverness. The empress is seated on the marble throne with the white disc behind her, which appeared in the "Justinian" of last year. Her arms rest on the sides of the throne; the background is mosaic. Not the least admirable part of the picture is the treatment of all this white marble, which, lending itself as it does to reflections and reflected lights, ceases to be white, and becomes of a beautiful rosy, mauvey, yellowish tinge. Theodora is crowned, and wears a robe of a dull green with a front of gorgeous golden embroidery; the whole ornamented with a mass of precious stones. Her outer mantle is violet velvet trimmed with gold. Now, from this description one would say that the face would lose its power. Not at all; it is as forcible as if the gorgeous coloring were absent. Note, too, the admirable painting of the emeralds. Mr. Ruskin somewhere points out the cleverness of the painting of an emerald or a pearl in some picture (I think Paul Veronese's "Darius,") but surely, even that critical writer would scarcely deny that Constant's jewels excel Veronese's. The only part of the picture I should take exception to is the hands; they are, perhaps, rather black and wooden.

An excellent portrait is M. Salanson's of M. Léon le Port in his gorgeous red robe trimmed with fur, that of the Sorbonne. M. Rixen's "*Laminage de l'acier*" is clever in the movements of the men, stripped to their waists, pulling out the ingots from the furnace, which throws a lurid glow upon them. M. Rochegrosse's "Salomé" is another splendid piece of coloring. The King is reclining upon a couch before which are many fruits and wines placed upon fabrics of the most gorgeous colors. Below the steps the girl dances, and behind are a set of courtiers at another table, behind which is a curtain showing above it some golden light striking across the pillared hall. It is a small picture, and naturally there must be more confusion of stuffs and personages than in a large one; still, even allowing for this, it strikes one that the figures are somewhat lost in the surroundings. But it is a fine study of color. The death of Cæsar is a brutal picture in every sense — subject, drawing, composition, and painting. M. Salomon's "Cassandra" does not look as powerful here as it did in the Academy, possibly from its having no surroundings of the same type in the London exhibition.

Mr. Pierce's "St. Génevieve" has some good coloring about it, and the sheep are well painted; so is the girl, but she is not of the stuff St. Génevieve was made of. This is a little common *gamine* of a Parisian suburb — rather gross than spiritual looking, a girl who might do very well in the capacity of shepherdess, or *femme de ménage*, but who never would have arisen to the heights of a St. Génevieve. This realistic treatment of sacred subjects is a mistake. M. Deschamp's "Adoration of the Shepherds" is full of character, but of the wrong sort. This girl is no beatified virgin, but rather a *Parisienne* worn out by poverty and starvation; and the shepherds are the sweepers and waterers of Paris streets. Again, the "Jeanne d'Arc" of Mr. Lucas has the same defect. That Jeanne was a peasant is true enough, but that she must have been something much more than a peasant is evident from what she did. The dull dense country-girl in this picture never would have become that grand character, the deliverer of France, and it is just that something, the soul, the mind, or whatever it may be, that a painter ought to try and depict when he touches on these subjects. There is nothing in the expression of St. Génevièvc or of Jeanne that distinguishes them one atom from the "*Bergères*" who abound on all sides of them. It is a pleasure to turn from M. Gervex's "*Avant l'operation*," with all its surroundings of doctors, instruments and sponges, to Mr. Bridgman's "Algerian terrace." M. Dautan continues in his atelier of sculpture — this year "*Un moulage sur nature*," the model being too natural, that is to say, not of perfect form, but the picture is clever and well composed. M. Dagnan Bouveret's portrait is one of the best pictures in the exhibition; crisply painted and beautifully modelled, it recalls some of Bandry's small portraits in its richness of tone. His "Pardon" is a fine study of Breton peasants, as full of sentiment as Breton's pictures of similar subjects but with less sentimentality. M. Henner has made a mistake in calling his innocent-looking little girl "Hérodiade." She is charming in expression and could not by any means be the bearer of the trencher with the Baptist's head. In the same way, one may take exception to the "*Créole;*" she bears a strong family likeness to certain "Magdelens" just as the "Hérodiade" does to "Fabiola" and others. But that does not detract from the masterly painting, the refinement of the work, and the perfect drawing. M. Henner's work looks so slight, but the modelling is most careful and studied.

One of the few pictures with any real religious feeling is M. Guillon's "*Arrivée du pardon de St. Anne de Fouesnant à Concarneau.*" Two sailors are pulling a boat ashore, in which are seated some girls in white muslin and lace caps, holding a gilded statue of St. Anne. Behind them, coming across the bay, is a fleet of boats filled with persons bearing banners. The sky is rose-colored, which is reflected on the sea; some boats have their sails set. The arrangement of color and the grouping of the boats are both very good, and the blue-white of the muslin gowns is a perfect study of white under the condition of a bright sky behind it. So, too, the expressions of the girls are excellent; they are not over-refined into ladies, and they are equally not gross, ignorant country bumpkins; there is no false sentimentality as in Feyen-Perrin's fisher-girls, nor is there the clumsiness of Lhermitte's women, but there is the true realistic appearance of the Breton peasant at her best, with the refinement that religious faith gives to the expression of the coarsest face — that M. Deschamps and others have failed to represent.

Another bit of realism in all its ugliness, but free from vulgarity, is M. Geoffroy's "*Les Rameaux*," a troup of orphans coming down the steps of the Madeleine with bunches of blessed box (which here takes the place of palms) in their hands. On the steps are poor women and children selling the "palm." It is exceedingly real and bright and fresh, but why need it be so ugly? I know there is a peculiar, heavy, fat-chinned appearance in orphans of all countries, and they generally look dull, but why not use a little poetic license and make one or two pretty?

Rembrandt painted a dead pig or sheep, and M. Cesbron has followed in his steps and given an enormous raw liver — large enough for the great mastodon. By the way, Rembrandt's "Lecture on Anatomy" is said to have been the model of M. Gervex's "*Avant l'operation*," with the slight difference that the one is a most powerful effect of light and shade and the other has no effect whatever.

There are a few very grotesque pictures. One I commend to lovers of sport: A huntsman of the stone age returns to his cave with a young buck to find a fine lion calmly sitting upon his wife's dead body. Tableau — great astonishment of the man, expressed by open mouth and outstretched hands, at the audacity of the lion, emulating the sportsman's taste. Another picture, a portrait, seems to have been too large for its frame, and although the feet of the man are full six inches from it at the bottom, the artist has cut off the top of the head to make it fit the frame. M. Besnard's eccentricities are amusing also. His "*Soir de la Vie*" represents two old persons dying, while behind, a young man seems to be tending the fire under a large vessel in which to cremate them. It might form the advertisement for a cremating company. I would suggest that the "*Femme nue qui se chauffe*" would do well to put on some clothes. All these are mere eccentricities to gain notoriety. M. Besnard is far too clever an artist not to be able to do otherwise if he were so minded. M. Moreau de Tours's work is always fine and broad, but what can be thought of "Mme. ———," who chooses to be painted on a garden bench suckling her baby (Mlle. ———) in sight of the multitude? True, she looks distressed, so much so that I took her for a well-dressed beggar-woman. But why, then, do it? "Mandolinata" errs in the same way. Why a woman in heavy velvet skirts should take off her upper raiment to play the mandolin is patent to no eyes but the artists'. These are of the class of pictures the British Matron should make a crusade against, not the refined nudities in which there is no harm but in the spectator's own eyes. One of the many clever still-life pictures is M. Otemar's "*Chez le chaudronnier*," — a mass of brass and copper vessels in every possible position. But good still-life abounds everywhere, as do first-rate portraits (M. Paul Dubois's small boy) and landscapes. M. Normann shows some Norwegian scenes under conditions of stormy skies and midnight suns — most brilliant work. M. Laurens' "*Agitateur de Languedoc*" is most vigorous and dramatic and withall more refined than some of his former works. Of all painters (since de Nittis's death) none render the southern sunlight as well as M. Montenard. His white

clad monks walking along the white road is vastly clever. M. de Mouvel's old people sitting on the beach is clever and refined; and in like manner, M. Lhermitte's "Haymakers" is excellent. Mr. Mosler's "Apaches" m kes one wish that more Americans would attack such subjects. True, tattooing is not beautiful, but the uncivilized red Indian is dying out, and it is a pity he should not be immortalized ere it is too late. There must be picturesque subjects without number in Indian life.

M. Comerre has surpassed himself in his portrait of Duflos as Don Carlos, arrayed in black and gold. The lady's portrait is fine as regards the dress and background, but the face is weak. Don Carlos is an instance of the wisdom of framing in other than gold frames. The picture would not be half so effective otherwise than it is. M. Béraud is, as usual, in the "Salle des Pas Perdues," realistic and powerful. The group of Northmen are well represented, MM. Melchers, Kuehl, and Skredsvig amongst others.

M. Bonnat's "Alesandre Dumas" is a work less black than usual with the painter, which is saying that it is a fine work, for, barring the tendency to blackness and the yellow background (both absent here) M. Bonnat's work is always of the best. Not so M. Carolus Duran, who seems to be going down hill. On the other hand, M. Cabanel is as fresh as ever. There is a certain dryness about his work, but his "Cleopatra" is well composed — a virtue which is rare with the *jeunesse* of the present day. I am a little tired of M. Gilbert's markets, and so I pass on to the sculpture which is very remarkable. In no other country do we find such life in this branch of art as in France. She seems to adapt it to modern views, or rather, she idealizes modern life. Peasants or fisher-folk are subjects fit for sculpture if properly treated, but if vulgarized as by the Italians it is prostituting art. "Dirty Boys" and children under umbrellas may be fit subjects for advertising soaps and parasols, but they are not art. On the other hand, what can be more refined than M. Guglielmo's "Fisherman mending his Net?"

Space will not permit me to describe all the works I have noted, but in the sculpture I should like to call attention to those of MM. Bourgeois, Perrault, Falguière, Worms-Godfary, Laoust, Beguine, Jacquot, St. Marceau and Cain.

The water-colors seem swallowed up by the fashionable pastels, but miniatures are increasing. Some are very charming (those amongst others of Mlle. Baily), and make one desire that such portraits may some day become fashionable again. Photographs never have and never will take their place. S. BEALE.

A DAY AT LISIEUX.

IT was a bright October morning when we first saw the old town of Lisieux. The white caps and blue blouses of the bronzed-faced peasants filled the streets with life and color, and as we entered the town and ascended the Rue Grande, which leads to the Grande Place where market was being held, we found ourselves in the midst of a scene of wonderful activity and bustle. At one end of the great square which is surrounded on all four sides by a double row of trees rises the cathedral, an imposing building approached by a broad and lofty flight of steps. Through the low stone arch at the left of the cathedral we caught a glimpse of a shady court-yard where stone steps with a balustrade led to the terrace above. Around the square are quaint, sombre buildings, which contrasted well with the rich colors of the glowing fruit and vegetables in the market.

In most of these small French towns there is a special market-day, usually Saturday, when the country people flock together, seemingly as much for the purpose of a friendly visit as for the more serious one of business. It is a day when care and trouble are banished from every face. Smiling countenances beamed from behind the stalls of tempting fruit and vegetables arranged with skilful hands, and the whole place was filled with the brisk gossip of men and women, and the lively bargaining of customers and vendors.

The dress of the women was full of low-toned color; only a few wore black-and-scarlet striped skirts. The bright-colored cotton handkerchiefs tied over their heads, white caps and blue aprons gave the color to their costume. The gaudy hues in which painters are fond of depicting Norman peasant women we saw only in the small fishing villages, where the vivid coloring seen in the dress of the people is conspicuous also in the gaily-painted roofs and striped gables of the houses. There the tints which might appear too crude and garish under other skies harmonize to a wonderful softness of tone under the peculiar mellowing effect of the atmosphere.

In La Haute Normandie the short loose jacket is commonly worn, but in La Basse Normandie the bright scarlet or orange and black neckerchief is worn across the shoulders in place of the jacket. These "*indiennes*," worn only on market and fête days, cost often from a dollar and a quarter to a dollar and a half, and are treasured for years. Everywhere through the Departments of the Seine and the Eure the men wear light blue blouses faded and patched, but at Lisieux, the shade becomes darker, and the patches almost invisible.

We left the sunny mirth of the market-place, and passed through the archway of the old building at the left of the cathedral, formerly the bishop's palace, now a sous-préfecture and containing a police tribunal and a prison. This palace was begun in 1637, by Bishop Cospéan, and probably served as a residence for St. Thomas à Becket, who spent the greater part of his exile at Lisieux. From the quiet court-yard on this side, in shadow, the merry crowd in the broad sunlight made a wonderful picture through the old archway. A steep flight of steps at the opposite end of the court leads to a broad terrace extending the whole length of the palace, from which we descended by flights of steps into a beautiful public garden.

Lisieux is situated at the bottom of a beautiful valley watered by the Torques and the Orbiquet. From these rivers there are many streams flowing through the town to work the mills, crossed by old and picturesque bridges. Artists find a rich field in the ancient many-gabled houses, with their marvellously carved fronts, in the exquisite contrasts of tawny green stone and red-tiled roofs, in gray bridges and glistening water, in the time-stained wood everywhere of a thousand brilliant hues.

There is nothing in Normandy to exceed in interest its domestic architecture. The finished details and good and massive proportions of these old houses show that they must have been very splendid before the peace of Normandy was disturbed by the troublous wars of the League and the Fronde. In the narrow Rue aux Fèvres, so narrow that it is difficult to sketch the tall buildings with over-hanging dormers on each side of the street, there are many curious houses, and one in particular is a study. It is known as the "house of the Rue aux Fèvres," and the carving is in an excellent state of preservation, although the building is more than four centuries old. Grotesque wooden figures about a quarter life-size support the brackets, and heavy oak beams elaborately moulded divide the stories. The carving between every window is bold and original. It would take too long to describe the wonderfully carved creatures to be found on almost every house in this street: pigs blowing whistles and bagpipes, dragons with huge serpents' tails, and men and women in quaint fifteenth-century costumes and head-dresses, ornament the corbels of these house fronts. We had heard that the interior of this especial house contained treasures also, and so entered the shop below where a lazy trade in boots and shoes was going on. In this room the beams of the ceiling were carved in all the designs, quaint and grotesque, that the Normans' inventive fancy could suggest. The shopkeeper was quite willing to have his dwelling admired, and readily consented to show us the rooms above, though he did insist that there was not much to be seen. We followed our guide up a narrow dark staircase, and into a room which he entered unceremoniously, scarcely giving the occupant of the bed who had evidently not yet arisen, time to draw a screen before his bed. This undue invasion of another's apartment to grant a favor to inquiring strangers might naturally have been resented, but no further heed was paid to our entrance; it was only one more to add to the list of our many amusing experiences. The walls of the chamber were ornamented with many curious designs, and the doors inlaid with panels, carved with odd, exquisite devices. As we were about to leave the room our companion intimated that he had still something more to show us. After an unsuccessful search for some article, he called in a shrill voice from the stairs, "Marie, Marie, *la clef!*" The round-faced, smiling wife, baby in arms, soon appeared with the missing key, and an immense wooden box was opened, and four wooden plaques or medallions, upon which were carved representations of mythological characters, triumphantly held up.

"What are they worth?" we asked.

"One hundred francs for the four," he replied, adding, "It is not dear, they are very old and well carved. They were taken from the walls of this room, and I have put them in this box for safe keeping."

Certainly the price was not high for such skilful workmanship, but we allowed him to lay the precious bits of antiquity carefully in their place for another purchaser. When we said good-bye to our friend, and offered him the customary franc for his trouble, he refused the silver with so much spirit, that we felt quite ashamed not to have perceived that he was above the ordinary fee-taker.

In the evening we wandered again into the same street, pausing often to watch the industrious people who did not cease their work with nightfall. Through the open doorway of a queer little shop we could see a shoemaker hard at work on his wooden *sabots*. His swarthy, ruddy face was lighted by a flickering candle and full of energy as he bent over his work, and with quick, energetic strokes of his sharp knife rapidly transferred the rude block into the shoe which satisfies the primitive wants of the peasant. He noticed the interest with which we watched him, and ventured to ask us if we did not wear those shoes in our country.

"They are far too heavy for us," I replied. "We should be clumsy indeed if we tried to walk in them."

"It is entirely a habit, madame," said he, "but what do you wear for the *boue?*" he continued.

"For the mud? oh, that is quite easily explained. We have overshoes made of rubber, which we wear over our leather shoes, to protect them from the wet."

By way of reply, however, he indulged in the inevitable shrug, murmuring almost under his breath, "*Mais la boue, la boue,*" not seeming to understand how anything but a wooden shoe could surmount this obstacle.

Piles of shining black *sabots*, newly painted, covered the tables, and there were plenty more waiting for the finishing touch of the brush. It is not strange that these heavy, clattering *sabots* make the women so ungraceful, even when the clumsy covering is exchanged

for a lighter shoe. We could not help contrasting their shuffling, awkward gait, as they clatter through the stone-paved streets, with that perfect freedom of motion which characterizes the bare-footed fisher-girl.

From the shadowy Rue aux Fèvres we found our way to the cathedral, or the parish church of St. Pierre, as it is now called. How wierd the old church looked in the dim light of the candles burning in the small side chapels and a few hanging-lamps, which shed at intervals a soft glow over the sombre aisles. Throughout the country the stranger upon entering these stately cathedrals cannot fail to be impressed with the simple piety of the worshippers. They come in the early morning, market-basket in hand, before the day's work begins; at mid-day, when the sun is streaming through the glorious stained windows, a moment is spared from busy toil in shop or market; and at night their feet are never too weary to cross the holy threshold of God's house. It must indeed be a sceptical mind that can doubt the sincerity of this people's religion, after seeing their faithful and earnest devotion.

Of the first church only a portion now remains. Here the son of Henry I was married to the daughter of Fulk, Count of Anjou, and also Henry II to Eleanor of Guyenne, the divorced wife of Louis VII. The rest of the church was burned in 1226. The deed of the endowment of this building records the repentance and self-condemnation of Pierre Cauchon, Bishop of Beauvais, who helped in the condemnation of Jeanne d'Arc. He founded the Lady Chapel in the fifteenth century, as a fruit of his repentance. There are a few beautifully-carved bits about the church, but the interior has a cold look, from the entire absence of stained-glass, which was probably destroyed by the Calvinists when they took the town and plundered the cathedral.

Lisieux is one of the fine old Norman towns that remain unmodernized, and we may dare to hope that the whirring wheels and tall chimneys of neighboring manufactories will spare the old houses which are such precious remnants from a Feudal age.

No one who visits Normandy can fail to note the vast difference which exists between English clergymen and French ecclesiastics, in the value they set upon ecclesiastical edifices solely as buildings. At Caen the beautiful and graceful church of St. Etienne le Vieux is filled with firewood, old vehicles and rubbish of all kinds, and the old Norman church of St. Nicholas, with its picturesque tower and round-headed doorways overgrown with ivy, is turned into a hay-loft for cavalry, and surrounded by an ugly stone wall. It seems strange that the authorities of Caen do not restore these interesting buildings to their original destination, instead of building modern churches. The inhabitants of Chester contrive to keep the characteristics of their ancient city intact, and still move on with the necessities of modern times; but the people of Rouen and other Norman cities seem to take pride in putting something most modern in character in place and by the side of that which is most ancient.

Although charming at any season of the year, Normandy should be visited in the springtime, when the hedges are rich with masses of primroses and cowslips, and miles upon miles of white-blossomed orchards cover the green sides of valleys. A. J. N.

COMMUNICATIONS

THE DESIGN FOR THE DETROIT POST-OFFICE.

Washington, D. C., May 11, 1887.

To the Editors of the American Architect: —

Dear Sirs, — Please publish in the next issue of the *Architect* that the design of the Detroit Post-office has not yet been "passed" by me. The Galveston design has been approved, and the working-drawings are now in course of preparation. All other designs which have been forwarded to you, in response to your request of November 4, 1885, have received my approval, and the buildings are now in course of construction. The perspective sent you was made at a cost of $61.15, and a full knowledge of its conception on your part would, no doubt, have prevented your premature criticism of the 7th instant. As a "public functionary" I have neither time nor disposition to enter into a newspaper discussion as to its merits or demerits.

Respectfully yours, M. E. Bell,
Supervising Architect.

[We regret that this letter reached us May 13 — too late for publication in our issue for last week. It seems to us that Mr. Bell advances what the lawyers call a plea in avoidance. The fact that he has not "passed" the design makes him neglect the fact that the Detroit reporter quotes him as saying of it, "I am pleased of [*sic*] the results, so far." Moreover, it is only reasonable to assume that an architect will not offer for publication a design of which he does not approve, and it is just this matter of personal approval by an official that makes us feel that the present condition of the Supervising Architect's office is so unpromising. As to our criticism being "premature," we will ask, after premising that we did not intend to write a criticism, but a rebuke, whether criticism of a design is most timely when offered before or after its adoption? There seems to be something like disingenuousness in the attempt to make it appear that this design was prepared at an insignificant cost. Probably the cost of the *perspective drawing* was only $61.15, but even in the Supervising Architect's office such drawings are not made at the first flight. The information we have gathered since the publication of the design leads us to believe that it cost the Government about $1,100 to have prepared, under the direct supervision of the chief of a very important bureau, a design as to the advisability of "passing" which the chief of that bureau now seems to entertain some doubts. — Eds. American Architect.]

Washington, D. C., May 11, 1887.

To the Editors of the American Architect: —

Dear Sirs, — As I am the designer referred to in your denunciations of the Detroit Government building, I beg to be allowed a little space in the *American Architect* to make a few remarks "for the defense."

I assure you, my dear sirs, after reading and re-reading the article in question, I was amazed. From the prelude of it I expected some criticism which I failed to find; what I did find was: you simply "call it names," which, as your own personal dictum, would amount to nothing to me, but the weight which the *American Architect* gives it demands a reply.

You say "it is not supposable that such an abomination *can be built*." You better read up "*Building Superintendence*," and if that don't give you the points necessary, I can refer you to a number of books that will. Everything about it has feet to stand on; nowhere has there been a deviation from scientific principles of construction laid down "in the books."

In your last paragraph, you wonder how it comes that the Supervising Architect can pass this design and not reject the one for Galveston. Well, I can tell you, it is because he is a liberally-educated, liberal-minded man — not at all "hide bound." You forget there is a possibility of the existence of things "beautiful, good and true" outside of the range of your horizon. I assure you this design is the result of the most careful and painstaking study, by all concerned, and while talent may be lacking in this work (for myself I never laid claim to any, only that for earnest, hard work, as is well known), yet there is a *raison d' être* for everything about it, while it has been the aim to go away from all the beaten tracks — no known or established law in form or construction has been violated. It is one organic whole, practical and convenient for its work, and probably the best-lighted large Government building in this country. There are a number of novel features in form and manipulation, overcoming serious difficulties in former methods, that have probably escaped your notice, as was the case with the most noted architect of Detroit (no friend to this office), who said, in an interview, after having seen a newspaper cut of it, "I consider it an *incongruous conglomeration of rubbish*." In a second interview, after having seen the large drawing, which was sent to Detroit for exhibition, he said the newspaper cut didn't give him a correct idea of it, and "if the building is completed according to the drawing now on exhibition, it will be one of the handsomest public buildings in the country."

Aside from him, I have heard criticisms of six prominent American architects (and of small fry, I don't know how many); three of the six belong to the *ten foremost professional names of America*, and while each one objected to some small feature or other, the opinion of *each of the six was exactly the opposite of yours*. Wherever a fault is pointed out to me, I do my best to cure it; I did so here. There was a standing invitation for criticism, and we got lots of it all along the road, and I was pleased to note one thing throughout: The travelled and cultivated layman was invariably delighted — sometimes went into extacies over it. The greater the reputation of the architect, the more he found in it to admire; the smaller or the less favorably known, the less he liked it. This should establish the fact that there are two sides to this question, and the poet is right when he says:

"Wenn deine Kunst dem Geck gefällt, dies ist mir schon ein böses Zeichen."

In conclusion, I must say I was surprised at the *temper* of your article. From your post I expect friendly *advice* and *instructive criticism*; blessing and Godspeed for every honest, earnest effort forward, instead of such a "cussing out" as you have just favored us with. Don't forget that the history of architecture is but a history of a succession of experiments — successful but once (!) in the course of time (the Parthenon) — and that what is good will *live*, in spite of you or your protests, no matter how emphatic.

If our generation shall succeed in formulating a passably respectable style of our own we should be satisfied. It is asking altogether too much to expect perfection in the earliest efforts.

Very respectfully yours, John Moser.

[We will first relieve Mr. Moser's doubts as to our knowledge of construction by explaining that when we expressed a disbelief that the Detroit design could be executed we referred to moral and artistic, not to physical and constructional possibilities. Next, as to the matter of "personal *dictum*": the opinion we expressed on this matter was, of course, the opinion of individuals, but at the same time was the opinion of those same individuals whose expression of opinion in the past has earned for the *American Architect* that very "weight" which our correspondent feels he cannot disregard. We appreciate fully the power of the weapon we have fashioned, and we hope we may never misuse it. Upon the merits of any given design there will always be differences of opinion. We suppose that even Churriguera, who sought to evolve a new type of Spanish architecture, as Mr. Moser does to found an American school, had his admirers and supporters; but in what repute are his designs held nowadays? For Mr. Moser, as a tireless worker, a thorough lover of and believer in architecture as a fine art, and as a designer of great ingenuity — where the subject is not beyond his grasp — we have a very sincere respect; but, like many enthusiasts, he miscalculates his strength. We can easily believe that he had well-considered reasons for every part of his design, but we fear that a statement of them would only increase our respect for his ingenuity. How great this ingenuity is our readers may remember; or, if not, they may discover by turning to his remarkable design for a building for the American Institute

of Architects, published in our issue for January 19, 1884. Here will be found, amongst other individualities, one pavilion into whose adornment is wrought a Pullman car, a horse-car, a grand piano, a jig-saw, full sets of mechanic tools, etc., distributed with perhaps as much ingenuity as baldness: an effort which is not unlikely to excite the risibilities of the observer until he turns to the elaborate description of the design and discovers with what earnestness, sincerity and lavish expenditure of time and thought the whole design has been elaborated, a discovery which commands for the intention and effort a respect which cannot be accorded to the result. We are willing to admit that we should probably admire the processes of ratiocination applied to the evolution of the Detroit design, but we do not believe that they would cause us to change our opinion of the result, namely, that it is a design which the architects of this country cannot allow to be carried into execution without protest. — EDS. AMERICAN ARCHITECT.]

CHICAGO, May 16, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — If you will permit a further expression of opinion on the subject of the design for the Detroit Post-office, I beg that you will allow me to second most heartily your criticisms upon that most wretched piece of work. In your last issue I notice a letter from a Chicago architect who actually "ventures the assertion that if you ask the opinion of the profession throughout the country you will find a fair majority that will call it good"! For the sake of whatever reputation Chicago architects may have, let me, in the name of all that is good, cry out against such words. We have enough atrocious work in this country now, without permitting favorable criticism upon this latest abomination to pass unanswered by every one who cares the least for the good of his profession. It is a shame — a shame upon us, as a nation — that the work of the Government should be put into such hands.

I beg that you will not drop this subject without publishing all the opinions that members of the profession are willing to give against this latest example of our national ignorance — for such it cannot fail to appear to those who do not know how carelessly our public officers are chosen. In France and Italy the Government work is the best that the people can produce. In the United States it is, more often than not, the worst; and it is high time that some strong movement should be started to purge the present system of doing the public work from its faults. It is for the *American Architect* to begin that movement.

Yours very truly, J. N. TILTON.

OUR GELATINE PRINTS.

CLEVELAND, O., May 9, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Having just read with satisfaction your remarks upon the subject of architectural criticism, in your last issue, I cannot refrain from expressing a few thoughts that have been in my mind for some time. Before proceeding with these, let me say that I think as you do, that it is a misfortune that you do not feel at liberty to criticise freely any design that you publish.

Your remarks upon the "design" for the United States Post-office and Court-house at Detroit are sufficient to convince me that such a course pursued with reference to many of the drawings you publish would not only be decidedly useful, but would tend to the establishing of a much higher regard for your architectural knowledge and taste in the minds of many of your readers.

As a subscriber to the "Imperial" edition, I cannot help feeling, to a certain extent, imposed upon in the publishing of a large part of the illustrations, which form a special feature of that edition. I refer to the gelatine plates, for the selection of which I assume that you are alone responsible, and in no way dependent upon the courtesy of any contributor. What there can be, for instance, in the "House on Bellevue Avenue, Newport," accompanying the current number, and "issued only with the Imperial edition," to justify this distinction, I am at a loss to conjecture. It seems to me difficult to conceive of anything more devoid of interest or architectural value. I hardly see how you could even point a moral from such a design as this, if you were to avail yourself to the utmost of the liberty of criticism.

With reference to some of the plates, which have at first sight excited my indignation, I have later become reconciled, and am prepared to believe that their publication in all the unflattering truthfulness of a photographic plate is justified by their value as curiosities: the view of a Methodist Church at Baltimore, recently published, is one such. Had that design been a reproduction of a drawing, I venture that a majority of your subscribers would have had a suspicion, at least, that, as you suggest with reference to the designer of the Detroit Post-office, some one had been "playing a huge practical joke." In fact, after looking at the heliotype, it is difficult to avoid that conclusion.

I do not wish to be hypercritical, and I think it is only reasonable to desire, and to expect, too, that of the extra gelatine plates, published for the extra price, every one should possess architectural merit, or interest of some sort, sufficient to justify its preservation; and that such has been far from the case in the past, I am by no means alone in the opinion.

Trusting that you will accept the foregoing as emanating from a desire to see the value and usefulness of your journal increased, I remain, Very truly yours, F. S. BARNUM.

[FIRST, as a reply to the grievance which Mr. Barnum feels he has against us for the choice we make of subjects for the gelatine prints, let us say that when we introduced these plates we announced that we could not promise that each subject should be the best of those which up to that time had remained unpublished, but that all we could promise was that in the aggregate the gelatine prints published should be worth the increased subscription price. Next, it is never to be lost sight of that a very important function of this journal is the presentation of an illustrated record of what American architects are actually doing. Even if we ourselves, and ninety-nine per cent of our readers, heartily disapproved of the design, still we should consider that a large and expensive ecclesiastical building, erected in one of the largest and wealthiest cities of the Union, after the designs of architects of the highest standing, was a very proper subject for illustration. As for the house at Newport, we might point out that any building with closed blinds and boarded openings is subjected to an unfair ordeal under the eye of the camera; we might say that the house when photographed was believed to be the dwelling of a man known to all the world, and, as such, of interest to the *οἱ πολλοί*; we might say that it was shown as an example of brick and terra-cotta architecture, but the truth is that it was simply a *pis aller* — one of those subjects secured during a day's work with the camera, without any real intention of making use of it, but in this case used because for one reason or another the other subjects under preparation could not be used. — EDS. AMERICAN ARCHITECT.]

A QUESTION OF COMMISSION.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I wish the following question decided, or, at least, your opinion upon it: I was engaged, some time ago, to furnish plans and specifications for a wharf and warehouse, and superintend the same. I agreed to give my full services for three per cent on total cost. Bids not being satisfactory, owner decided to build on his own account under my superintendence. Warehouse was built upon a brick foundation, but the concrete bed specified was not put in (with my consent). As soon as the warehouse was completed, I received $75 on account. The warehouse was filled with lime, cement, etc., and settled so that repairs were made necessary. Am I entitled to pay for my superintendence, or not? The owner, being his own clerk-of-the-works, have I a right to know the exact cost of the building? I purposely give you the plain facts, in order not to prejudice your opinion in my favor, and, therefore, will not state why I consented to the concrete bed being left out, or make any other excuses.

Please answer the above as soon as you can, as I intend to be guided by your decision or opinion in this case.

Yours very truly, C. E.

[C. E. does not give us facts enough to judge very clearly of his case, but if he, an expert, undertook to supervise the construction of a building, either from his own designs or some one else's, and, knowing that the building would be used for the storage of heavy goods, was so negligent as to omit ascertaining the character of the ground on which it was to stand, or so careless as to allow an insufficient foundation to be substituted for the proper one specified, so that serious settlement took place, he is not, in our opinion entitled to receive anything for his services as superintendent. In regard to the second question, it is well settled that if two parties make an agreement by which one is to be paid a certain percentage on the expenditures made by the other, the latter must render a true account of such expenditures, in order that the percentage may be calculated. In an English case, where an architect had to sue an owner for his fees, the judge ordered the owner's books to be brought into court, so that the proper percentage might be reckoned, and the same thing would probably be done here. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

SUFFOCATION IN WELLS. — M. Gréhaut recently read a paper at a meeting of the Biological Society of Paris on "The Prevention of Accidents from Suffocation while descending Wells." The cause of suffocation under such circumstances is the presence of carbonic acid gas; and M. Gréhaut suggested the following plan for discharging the gas from the well. A pipe some 10 feet or 12 feet deeper than the well is let down into it and secured by the sides of the well. A grate on which a fire can be built is then to be placed around this pipe at the level of the ground, and a second pipe, larger than the first, is then to be placed upon the grate having the first pipe inside. On the grate between the pipes a fire is to be built, which, heating the inner pipe, will create a draught and draw off the noxious gas.— *Engineering.*

A BIG STRIKE AVERTED. — A refreshing little story, illustrating some curious relations between employers and employés, comes from Whitney's Car-Wheel Works, at Sixteenth and Callowhill Streets. Some few weeks ago the 200 employés of the foundry, which covers the entire block from Sixteenth to Seventeenth Streets and from Callowhill Street to Pennsylvania Avenue, were on the verge of a general revolt, not because of anything the firm had done, but on account of the action of their subordinates. William Thomas, assistant foreman to John Thomas, the chief, had, in the absence of his brother, discharged two tried and trusted employés, Thomas Moffat and William H. Horstman, and had filled their places with three other Irishmen. That caused the trouble. Strange as it may seem, that was in direct violation of one of the rules of the works. Old Asa Whitney, the head of the firm, before he died, fourteen years ago, had directed in his will that no faithful employé of his foundry should ever be discharged by his successors, and that no reduction in wages should ever be made. Moffat, who is a sturdy, self-reliant body, knew this tradition of the works, and immediately after his discharge he went directly to headquarters. He laid his case before John L. and James S. Whitney, the sons of the founder, and proved that Assistant-foreman Thomas had discharged him because he refused to do an impossible thing. The two brothers Whitney summoned the two brothers Thomas before them and investigated the case. The result was that last Saturday evening the latter were both discharged. Peace and good will were restored in the

foundry, and the employés talk proudly of the loyalty displayed by the firm in discharging the foremen and reinstating Moffat and Horstman; following the spirit of Asa Whitney's will.—*Philadelphia Press.*

REPRODUCTION OF AN OLD TYNE BRIDGE.—Following the popular precedents of "Old London" and "Old Edinburgh," a notable feature of the forthcoming Royal Mining, Engineering, and Industrial Exhibition on the Town Moor, Newcastle, will be a reproduction of the old bridge across the Tyne. Having stood for more than 500 years, that bridge was destroyed by a flood in 1771. It was largely constructed from out of the ruins of an earlier structure which had replaced the the bridge of Hadrian (A. D. 120). Having a tower and portcullis at each end, it was, like old London Bridge, crowded with houses. It had also a central stronghold, together with a chapel dedicated to the Virgin. Here, according to Lanercost's *Chronicle*, was exposed the right-side quarter of William Wallace. In later times the remains of an Earl of Northumberland and of other worthies were similarly displayed.—*London Paper.*

A BLACKSMITH'S EPITAPH.—Carisbrooke Church, said to be founded 1064, has been partially restored, says the *British Architect*; it is beautifully situated, surrounded by a fine old churchyard, adjoining the "Priory Farm House," the site of the priory attached to the old church. There are a few monuments and a pulpit, dated 1658. The tower contains eight bells. There is some fine bold carving on the pinnacles, and the view from the tower is magnificent. There are some curious stones in the church-yard: a slab over the grave of a farrier has the following lines:

"My sledge and hammer lie reclined.
My bellows, too, have lost their wind;
My fire's extinct, my forge decay'd,
My vice all in the dust is laid;
My coal is spent, my iron gone,
My last nail's driven, my work is done."

THE STRIKES IN APRIL.—*Bradstreet's* says, that during the month of April the number of strikes by or lockouts of industrial workers throughout the United States was 123, a total far in excess of the number in January last, 92. The largest number of strikers in April were in the building trades, about 14,600; next the stove-moulders, over 5,400; then the iron-workers, about 2,300—which classes account for two-thirds of the total striking that month. April strikers by trades, as reported to *Bradstreet's*, are as follows:

Leading lines reported.	No. Strikes.	Strikers.
Transportation, marine and allied trades	2	160
Steam railways	2	480
Coal mines	7	1,745
Boots and shoes	2	730
Tobacco	3	419
Cottons	7	907
Woollens	5	985
Clothing	2	650
Silk	1	25
Iron, etc.	12	2,335
Steel, etc.	3	300
Machinery	2	355
Coopers	1	100
Miscellaneous	8	1,105
Stove-makers	24	5,474
Building trades	27	14,642
Salt-makers	1	350
Printing	1	16
Silver-workers	2	270
Copper	3	65
Glass-workers	3	581
Lumber	2	40
Carriage-makers	2	140
Pottery	1	30

The total number of employés striking or locked out during April, about 32,000, is nearly twice as many as were reported striking in March, nearly one-third more than in February, and but four-ninths of the total for January last. The totals of strikes and of strikers by months for four months of this year and last are as follows:

1887.	Jan.	Feb.	Mar.	Apl.	Totals.
Total number strikes	92	75	87	123	376
" strikers	73,300	26,000	16,965	31,910	148,185
1886.					
Total number strikes	19	5	16	9	49
" strikers	47,200	10,700	50,200	22,606	130,700

The total of strikers in April last year was but two-thirds as many as in April, 1887; was not equal to one-half of the total for March; was more than twice as many as in February, and less than one-half of the total for January, 1886. The total number of labor-strikes and lockouts this year to April 30, is 376, against 49 reported in a like portion of last year. The total number of men involved is 148,000, against 130,000, a gain of 14 per cent.

TRADE SURVEYS

IN between twenty and thirty large cities throughout the country associations of employers have been formed within the past twelve months for mutual protective purposes, or, rather, for defensive and offensive operations. The tendency to organization has been caused and stimulated and nurtured by labor agitations, and it may be said to be in its infancy. Employers to-day, unless they have carefully studied the labor problem in all its bearings, or have forecast the advantages to be derived from harmonious action on their part, do not understand the extent of the field into which they are just entering. The advantages will be many-sided; first, that of protection against the unjust or insolent, or arbitrary demands of labor; second, the moral effect upon labor which such organization will have; third, the restriction of competition, and the establishment of *entente cordial* between the employing interests themselves—a spirit which is very much needed; fourth, the creation, where it does not now exist, and the firmer establishment, where it does, of confidence between capital seeking industrial investment and those who will superintend its operations. These specifications would be continued but there are enough shown in the few to roughly define the limits of the field to be filled by the new organization movement among employers. Competition is said to be the life of trade, but it is oftener its death. The organization now going on among manufacturers will very largely define and establish the legitimate limits of this spirit of competition. Heretofore, in our industrial progress, it has been running wild. Too much competition, like too much liberty, is productive of very disastrous results. In Great Britain it has established a condition of chronic poverty among millions. On the Continent it has made progress, outside of certain narrow limits, an impossibility. In the United States it has made disasters a sort of commercial necessity.

This question will bear a great deal of agreeable theorizing, and the deduction of a great many seemingly-plausible conclusions. A general combination among employers has never heretofore been thought of. In fact, so great has been the opposition to it, or, more strictly speaking, so little has attention been given to it that nothing, comparatively speaking, has been done by preconcerted effort. Employers have been thrown and dragged together by force of circumstances, and have been compelled to talk over trade matters, and act in harmony. The experiments that have been tried have so far produced good results. One other feature which recent labor agitations have developed, is that which is called the "profit-sharing movement." The great body of employers look with suspicion and distrust upon it. It embodies a surrender of prerogatives which they have heretofore supposed to belong to proprietorship. After all, the notion is more of a sentiment than a reality. The profit-sharing movement is destined to meet with a wide acceptance. Within the past two months some twelve or fifteen experiments have been inaugurated, and it is probable that during the year many others will be made. The out-and-out trades-unionist is opposed to it. It is favored by that class of laborers who are not in a position to successfully organize or to act in concert. The idea is favored by employers of a humanitarian turn, who mix sentiment with business, and who hope for honor as well as profit through the experiment. There are certain strong features in the profit-sharing system which commend themselves to employer and employé, and it is likely to be tried on a large scale, and frequently as an alternative against strikes and their consequences. The general tendency is to a juster division of the profits of labor. Capital is gradually receiving less, excepting where it can be controlled in a speculative way. Labor is gradually receiving more, as the industrial statistics everywhere show. Yet in the long run, labor will be the hewer of wood; capital will be shrewd enough to seize upon advantages and opportunities which labor cannot foresee, or, if it could, could not take advantage of. One of these opportunities is the buying of the land of the country, to be parcelled out and sold at all sorts of extravagant prices. This is about the meaning of the real-estate boom we read of. The generally healthy condition of industry and trade is protected by the assurance of a steady increase in the volume of currency. The heavy purchases of Government bonds during the past year are helping to crowd industrial capital into new directions. The silver certificates, the foreign investments, and the rapid increase of negotiable paper, are all helping to swell the volume of business, to strengthen the confidence of the wise and the ignorant, and to multiply and expand opportunities for money, energy, and labor. The industries themselves are gaining in strength every week. The latest iron-trade summary shows that the production of crude iron has reached over 138,000 tons per week, or over 6,500,000 tons per year, which is 1,000,000 tons in excess of the production of 1886. The steel-rail production this year will, in all probability, be forty per cent in excess of last. The increase in bessemer steel of all kinds is at the rate of not less than forty per cent, and the increase in other kinds of material is nearly in the same proportion. Despite this enormous increase stocks of iron and steel are an unknown quantity. Importations are assuming what, to the American manufacturer of iron and steel, are alarming proportions, viz., at the rate of 3,000,000 tons per year. The actual importations of iron and steel, including iron ore and tin plate for the last nine months, are in excess of 1,800,000 tons. The foreign contracts now being executed amount to at least 500,000 tons of materials of all kinds, which will be poured into this country during the summer months. Despite our enormous production and enormous importations the markets are practically bare, and buyers are seeking sellers, and sellers are holding to strong prices and talking of further advances before the season is over. The anthracite strike, which was trumpeted abroad a week ago has, to all appearances, suddenly collapsed, and the anthracite coal producers have put the cap on the climax by ordering a suspension of production, for a week, beginning Monday, in order, as they say, to effect a desirable depletion of the one million tons of coal at tide-water points in the interests of better prices. They are hitting two birds with one stone, viz., higher wages, and the miners' strike. The Connelsville coke-workers are deeply embittered at the results of their arbitration, and are hurling back the taunts thrown at them by their co-workers and their employers. The developments in the lumber trade during the past six days, are in favor of strong, and possibly, stronger prices for yellow and white pine, spruce and hemlock, poplar and oak. The car-builders are heavy buyers of hard wood: the house and shop builders, of poplar and spruce, while white and yellow pine and hemlock seem to go into consumption everywhere, about as fast as rail and shipping facilities can deliver it. Prices have continued very firm, and while it is possible that prices may be firmer, by the development of an extraordinary mid-summer demand, the probabilities are that they will remain about where they are. The saw-mill capacity of the country is driven to its utmost capacity. The distribution of the multifarious products of New England shops and factories, has been in no wise checked by the slight depression of the past two weeks. Some of the more prudent manufacturers of woolens and woolen goods, are restricting output, but the industry at large, is producing more yards of cloth this year, than last. The boot and shoe-makers have had a very prosperous season, in spite of strikes, and the "free shop" movement is promising some little comfort to employers. The manufacturers of heavy machinery, boilers and engines, as well as of electrical appliances, are loaded up with orders, from one to three months ahead. The industries of the Middle States are exceptionally prosperous, and trade journals exhibit a slight improvement in the general demand. The great factor of railroad construction is still wielding its powerful influence in favor of expansion and strong prices. Numerous inquiries are coming from the South for more machinery and material. One Pittsburgh mechanic, only last week, closed contracts with an Alabama syndicate for two more blast furnaces, to cost $450,000. The string of new enterprises in the South and West, strongly backed by capital, are becoming rather monotonous, but they show that there is an abundance of money, enterprise and faith among the leaders of industrial activity.



SOUTH SIDE OF MAIN ROOM, CONTAINING PROF. MORSE'S COLLECTION OF JAPANESE POTTERY.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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MAY 28, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

THE telegraph brings the news of the death of Mr. Horace Jones, the architect to the City of London, and a man of very considerable note in the profession. He was sixty-eight years old at the time of his death, and had held his appointment for many years. As with most architects in official positions, where they can do more good by judicious advice than by startling novelties in design, his professional work was distinguished for quiet respectability rather than originality, and some years ago, when he was a candidate for the Presidency of the Royal Institute of British Architects, in opposition, we believe, to the late George Edmund Street, the point of his lack of distinction as an artist was constantly brought up against him. Notwithstanding this, he was elected, and administered the office with a gentle dignity, which won him universal esteem, and his fellow-members will sincerely regret his loss. Since his retirement from the presidency of the Institute, his best-known work has been the design for the Tower drawbridge across the Thames, which he devised in connection with a distinguished engineer. The engineer was probably responsible for the plan of a double roadway, one to be above the reach of ships' masts, for use in crossing while the main bridge was opened for the passage of vessels, but the architectural treatment of the problem, which was certainly not an easy one, must have been the work of Mr. Jones, and it was certainly successful enough to do credit to any architect in England, and attracted much attention on the Continent and in this country.

THE people who claim to have become convinced, through some process of reasoning peculiar to themselves, that labor organizations and strikes are useful to working people, rarely pay any attention to facts or statistics, or the report of the present condition of the iron trade in England would interest them. Every one has seen or heard of Wolverhampton, the once prosperous centre of the English "Black Country," whose coal and iron brought comfort and wealth to many thousands of the more or less thrifty people who inhabited it. Twenty years ago there were, within three of the towns, forty-seven smelting-furnaces in blast. There is now but one, and the owner of that, a man who has been in the business for nearly fifty years, and has paid out in wages not far from ten million dollars, is about to abandon it. There is no change in the natural conditions. The owner of the furnace also owns mines, which, as he says, would furnish material to carry on the works for fifty years longer, but the miners, by combinations and terrorism, have succeeded in establishing an eight-hour day; and as they cannot, or will not, in eight hours a day dig out enough ore for him to enable him, after converting it into iron, to sell it for what it costs him, he has concluded to put a stop to what, he says, "was once a profitable business, but is now a heavily-losing one." With his abandonment of his mines and furnaces, the five hundred men, with their wives and children, who have been living on the wages which he paid them, will be turned adrift on the world, many of them to become a burden on public charity. If they had wished, or, we might say, if they had had loyalty and sense of honor enough, to do faithfully the work which he employed them to do, both they and he would be in the full enjoyment of present prosperity and confidence in the future; but they chose to listen to the gospel of shirking and disloyalty so industriously preached by loquacious adventurers, and reap the fruits of the successful reduction of their doctrines to practice. In their case no hope remains. While carpenters, masons and mechanics can usually get work of a certain sort after cutting themselves off from regular employment, a miner or an iron-worker is helpless. Probably Mr. Sparrow, in consideration of their necessities, would willingly allow his men to extract ore from his mines, and try to smelt it and sell it on their own account; but the mines are filled with water, and must be pumped out before any ore can be dug from them. He has no more money to sink in the business, and they have none to hire pumps with; and no one, knowing their peculiar view of fidelity to obligations, would trust them with any, so they would have to remain idle, even if their late employer should make them a gift of his property.

MR. AITCHISON, who now holds the rather peculiar position of Professor of Architecture at the Royal Academy, succeeding the late Mr. Street, recently read before the London Architectural Association a clever paper on the education of architects, many parts of which are worth remembering. All architects will appreciate thoroughly the sentence in which the substance of the discourse was summed up. "It is the fashion," said the lecturer, "to talk of architecture as if it were a very easy and simple art, so that unless a man is equipped with many other things besides architecture, he has not much to boast of, as Ben Jonson says of the cook, 'He is an architect, an engineer, a mathematician, a philosopher.'" It might be due to his own incapacity, said the lecturer, that he had never been able to agree with this view. He had had his attention called sufficiently often to the examples of Vitruvius, Orcagna, Brunellischi, Alberti, da Vinci, Michael Angelo and Wren, who are not only architects, but poets, sculptors, mathematicians, and so on, but these examples only suggested to him that there were now and then in the world men of such rare genius that they could do two things well instead of one, and feeling himself to be a person destitute of genius, he was the more convinced that the best and safest way for him was to try to learn only one thing, but learn that thoroughly. The nature of the thing which he, like ordinary aspirants for success in architecture, ought to study he conceived to be indicated by the experience of mature professional life. So far as his observation went, a practising architect was expected to know how to build what his clients wanted, and to make the structure convenient, strong and beautiful, without excessive expense, and if he knew this, he was rarely called upon to display any acquaintance with other arts or sciences. Something, it is true, was desirable in the way of accomplishments, to enable an architect, like any other professional man, to mix pleasantly in society, and a young architect, to make himself agreeable to his clients, if he should have occasion to visit them, might well know how to dance and play lawn-tennis, just as an older one should be able to talk entertainingly and take an intelligent interest in whist or rural sports; but notwithstanding the common idea of architectural education, he had never known a professional man's prospects seriously injured by an inability to recall the names of the principal mediæval architects, or to read at sight a Greek play. There was, to say the least, good reason to believe that the mediæval and Saracenic architects could not have told who designed the Parthenon, but they were perfectly and thoroughly familiar with the materials which they used, and with certain empirical science of construction, and this knowledge did for them what our multiplied branches of instruction do not do for us.

IT is curious to find Mr. Aitchison, who has a high reputation as a decorator, and an architect of rather poetical genius, asserting, as he does in the course of the paper, that "practical geometry, stereotomy and stone-cutting are shamefully neglected among English architects;" and he goes on to say that "all the great architecture of the world has had geometry for its basis, and little that is great and good will reappear until architecture has been again based upon it." As compared with the mediævals, the best constructors that the world has ever seen, we have a great advantage in the possession of simple and sure methods of determining strains and resistances

of materials, but this advantage is much more than counterbalanced by their infinite superiority in practical experience, and close observation of materials, and the inventiveness and daring in construction which such knowledge inspires. If we are to emulate their success, we must follow their methods in the modern way. "Every man preparing to be an architect should be able to solve the statical problems of how thick an isolated wall should be in proportion to its height, to resist a given thrust; the formulas for the resistance of uprights to a load, with the coefficients for brick, stone, iron and timber; the pressure of water against the sides of a tank; the thrusts of arches, vaults and domes, and the determination of strains and resistances in girders and roofs." The architect, said the lecturer, must know also the qualities of the principal materials, and the proper modes of putting them together; besides the principles of healthfulness in buildings, and the means of securing it; the substance of the common and the statute law in relation to buildings and contracts; and he should make a careful study of planning, and have thorough and systematic practice in design. In his opinion the study of styles in design should be made more a means of analyzing the methods by which certain effects were obtained than as an exercise for the memory; and he would, in proposing a problem in design, avoid specifying that it must be in a given style, and say instead that the building must have an imposing, or graceful, or threatening character, as the case might be. This last suggestion strikes us as being a valuable one. We ought not to forget that except as a means of expression, architecture has no claim to be regarded as an art, yet the systematic study of architectural expression, as shown in actual examples, has hardly been thought of in our schools. Perhaps, if well managed, such an investigation might help more than anything else in the solution of that vexed problem, the creation of a modern style. Mr. Aitchison well says that the "isolated and divergent energy" of the profession might be applied much more effectively to the furtherance of art by greater unanimity in the choice of a type; and nothing would do more to facilitate the choice than a clearer understanding among students and architects of the sources of those impressions of breadth, unity and proportion which are independent of style, and in comparison with which the details devised by classic or mediæval taste are of small importance.

THE ever-interesting *La Semaine des Constructeurs* contains an article on a new announcement, of importance to architects, which has been made by the French Minister of Public Instruction, and which recalls, in a manner very unusual in France, the ignorant arrogance with which English functionaries sometimes see fit to deal with professional men. M. Berthelot addresses his circular to prefects and officials generally who may have to look after the construction of public buildings, especially of school-houses, which are the buildings which come particularly within his province, and notifies them that he will have nothing more to do with any requests for authorization to spend public money on any extras whatever in connection with a contract duly approved. Like most other people who know nothing of the subject, the Minister imagines that extras on a contract are generally ordered in some way for the benefit of the architect, and he formally warns them that in future the engagements of architects to conduct public work over which he has control will contain a clause by which the architect "expressly agrees that on his personal responsibility the cost of the work shall not exceed the limit named in the contract." M. Rivoalen, who writes the article commenting on the circular, speaks much more respectfully of this ridiculous clause than we are disposed to do, but he points out with sufficient force that in at least nine cases out of every ten, extras on contracts for public works of the sort are ordered or suggested, not by the architect, but by the mayor or other official superior of the architect, who, as he says, wakes up every morning, while the building is going on, with a new idea, which he wishes to see realized forthwith. If the architect resists, saying that this is not in the contract, and that he is personally responsible for extras, the official is offended, and immediately puts in force another stipulation of M. Berthelot's circular, which reserves to the administration the "absolute right" of dismissing the architect at any moment, and installs some new candidate, who proceeds to carry out his predecessor's design as he thinks fit. Even if an earthquake should occur, or a quicksand should be discovered in the cellar, or if during the years that elapse before a project for a public building gets through the Circumlocution Office to final approval, prices should have changed, the architect, according to M. Berthelot's circular, is equally bound to pay the difference between the cost of the executed building and the estimates out of his own pocket, provided he should have succeeded in dodging the inspirations of the mayor long enough to arrive at the end of his work.

IT is hardly necessary to say that no architects, except those who have nothing to lose, or those skilled in the practices by which all public work is made to yield a profit, will concern themselves with M. Berthelot's buildings until the circular is withdrawn or changed, although it is, to our mind, impossible of judicial enforcement. As M. Rivoalen points out, by the common law a professional man whose employment, as is stipulated in one clause of the circular, may be terminated at the pleasure of his employer, is not a free agent, but the servant of the employer, and cannot be held, even by contract, to any responsibility whatever for his acts in the fulfilment of his service, beyond the liability to dismissal if his work is unsatisfactory; and if, as a very eminent judge once said, "it would be monstrous to expect a lawyer to know all the law," it is still more preposterous to expect an architect to foresee every one of the myriads of items which go to make up a building; so that an architect who had not been expressly warned beforehand could not be forced to sign a clause assuming the risk of all contingencies; and, if he had been engaged, for instance, in pursuance of the terms of an ordinary competition, he might demand and recover his full fees in case the other party refused to allow him to carry out his work without signing it; but no architect can spend his days in ascertaining the law, and the margin of profit in professional work is far too small to make it worth while to accept commissions with the risk of an acrimonious suit attached to them. For the benefit of the tax-payers of the French communes, however, upon whom the effect of this precious circular will fall far more heavily than on the profession of architecture, we will point out how it is likely to increase their burdens. It is hardly necessary to say that he who takes risks, or guarantees what he knows nothing about, does not do so without intending to be liberally paid for his trouble, either directly or indirectly. The impecunious or unscrupulous architect who professes to be willing to give such guaranties as M. Berthelot demands is usually quite astute enough to deal with them. His first expedient is to come to an understanding with the builder, either privately or publicly, by which the latter relieves him of responsibility. We once saw a contract for an important public building, which wound up by saying that "this contract is intended to be for the building aforesaid complete in every particular; and everything necessary to make it entirely perfect is to be done by the contractor, whether anything is said about it in the plans and specifications or not." With such a contract as this it is hard to see how the architect could suffer; and under M. Berthelot's circular such contracts would be sure to be made; but any man of sense can judge whether they would be economical for the owner. A ten, fifteen or twenty per cent margin for contingencies is much more easily added to the builders' price than to the architects' fees; and while a faithful architect would hold even a contractor who had relieved him of responsibility to his agreement, there would be a strong temptation to both, if the mayor's inspirations proved uncontrollable, to make up for the unexpected additional expenses which he caused them by economy in places where the saving would be unobserved; and most architects, being human, would be disposed to provide, of course at the expense of the owner, a reservoir of this kind, to be drawn upon in case of need, for the protection of their own lean pockets, if not of those of the builder.

ACCORDING to a Hungarian paper, the longest tunnel in the world is one constructed many years ago in the mines of Schemnitz, a little town of North Hungary. Many of the mines belong to the Crown, and all these are connected together by subterranean passages; while a vast adit, ten feet wide and twelve high, runs below the mines, draining them all, and extending to an outfall in the valley of Gran, ten and one-quarter miles away. The Saint-Gothard Tunnel is a little more than nine miles long, so that the splendid work at Schemnitz, which is so graded that it can be used for railway trains, considerably surpasses it in length. The total cost was about five million dollars; but it is estimated that the saving in expense of pumping alone, which is secured by means of it, amounts to one and one-half per cent on the cost, independent of its use for giving direct and convenient access to the mines.

THE MORSE COLLECTION OF JAPANESE POTTERY.



Ancient Pottery.

THERE is a peculiar fitness in the fact that the largest, most valuable and complete collection of Japanese pottery in the world should be found in the quiet old city of Salem — of American places the richest in its associations with the Orient. One pleasant autumn evening in 1886 the writer stepped into the handsome Salem post-office — a new, but not modern-looking building, in the quaint Colonial style that best indicates the character of the historic city. Upon the black-board bulletin was chalked a notice that the mail for China and India would close upon a certain date. A singular notice for the post-office of a provincial New England city, it seemed, but in this place it carried a touching sentiment in its suggestiveness. The great East India trade, upon which the wealth and commercial renown of Salem were founded, has long since vanished. But in these few lines, chalked down as a matter of general public interest, the persistence of an old habit was illustrated. Slow indeed, if not comparatively infrequent, must have been the postal-communication with the East in the days when the mails carried from the counting-rooms of old Salem magnates voluminous correspondence with their numerous Oriental connections. Few business letters are probably now exchanged between these remote quarters, once so intimate, but perhaps the writing of this bulletin means the continued existence of those stronger associations of friendship which business relations are often the means of establishing, maintaining the ties of the soul long after the lines laid down by material interests have been broken. Therefore we may be allowed to picture some silver-haired, retired merchant, whose house is filled with rare old porcelain and delicate-textured and rich-hued Oriental stuffs — abundant treasures of which are to be found in many a mansion in the city — impelled still to write to old-time friends who linger in the East; English merchants, it may be, or perhaps some Mandarin or Brahmin with whom circumstances may have cast down prejudices and barriers of race and rank, and brought into mutual recognition those communities of mind and soul common to all humanity, and which, when recognized, make men brothers, however birth, training, or intervening lands or seas may have separated them.

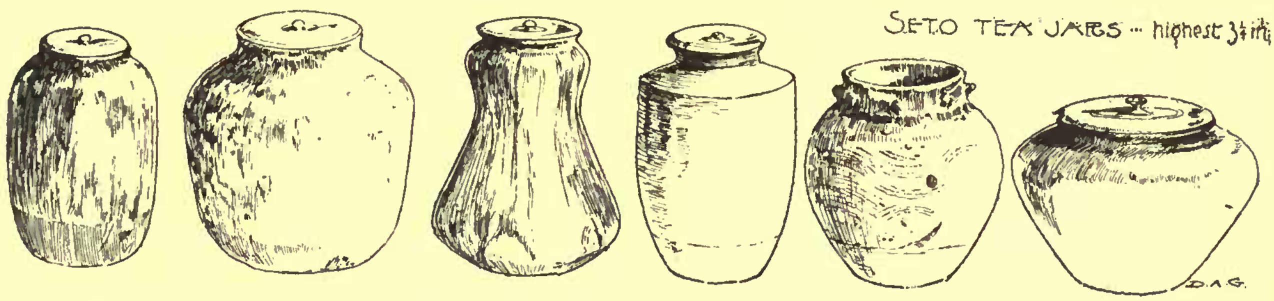
The proud Oriental commerce of Salem has, perhaps, had a loftier significance, and in influence may be perpetuated in deeper and more subtile effects than has been dreamed. It created the wealth which exists in the community to-day, and which is the basis of much of its culture. The trade of the old town, reaching out into many remote parts of the world, carried the interest of the people outside of themselves, their own narrow range of actions and events, into the doings and happenings of manifold other nations and races. The scientific eminence which Salem has attained doubtless largely owes its existence to the alertness of interest and breadth of mind thus awakened. Its commercial period having passed and served its purpose, and the place having become a quiet, refined and intellectual community — though still industrious, growing, and prosperous — perhaps the mission of Salem, the pioneer settlement of the Puritans on Massachusetts Bay, may be as a scientific centre, already of no mean eminence, to convey to America many of the lessons to be learned from the varying aspects of human life in all parts of the world. These aspects are illustrated in the unique East India Marine Museum, the visible sign and heritage of the past commercial glories, and the creation and pride of the old-time ship-captains and merchants; in the incomparable Morse collection of Japanese pottery; and in other institutions centering there.

In the days of Salem's Oriental commerce there was, to be sure, little doing with Japan, which was self-sealed against intercourse with the Western world. Salem's connections were mainly with China, India, and the Spice Islands. But now that Japan has since developed itself as the most progressive nation of the East, rapidly changing its manners and ideas into accord with Occidental institutions, there is a poetical appropriateness in the fact that Salem should possess, in the shape of the Morse collection, an after-math from the old field; a token of things as they existed in her day in a quarter then unexplored, and where those conditions are now rapidly changing. As Salem herself has contributed towards the Renaissance of Japan, for the Imperial University the services of two of her best minds in the persons of Professors Morse and Fenollosa, it is well that this return should have come to her.

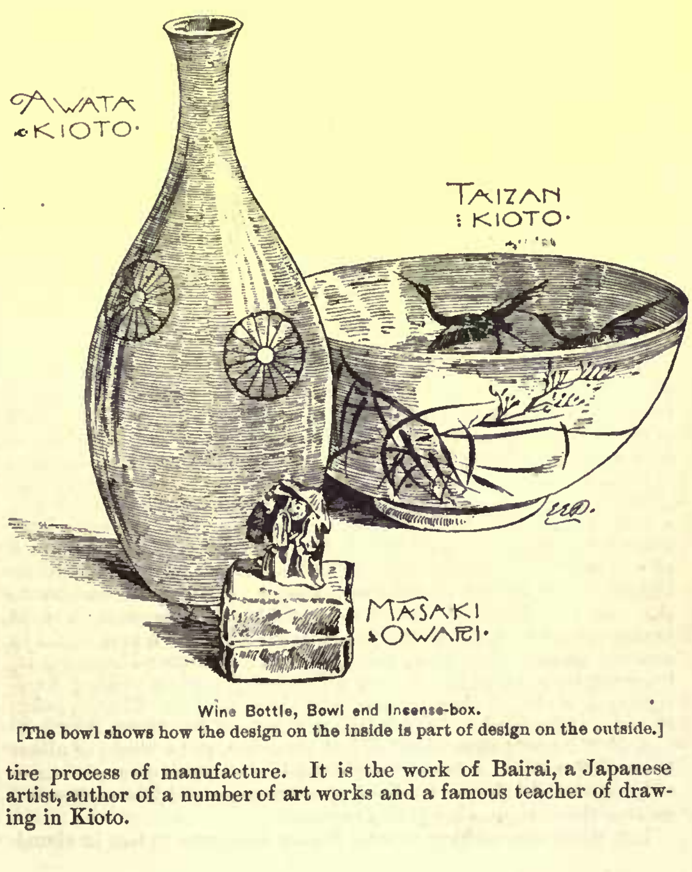
The collection, as it exists to-day, is to be found in the house of its owner and gatherer, Prof. Edward S. Morse, Director of the Peabody Academy of Science. The main portion of it is contained in a pleasant gallery, built expressly for its accommodation. The size of this apartment is eighteen by thirty feet. The rest of the collection, less interesting to the visitor, but essential to its completeness, occupies a room of the same size in the basement, directly below.

The main room is a charming place, fitted up in quiet harmony with the character of its precious contents. It is used by Professor Morse as his daily study, and he thus lives in continual intimacy with his collection. One who has seen something of the fascinating character thereof may appreciate how it must have, in this way, grown into the life of him who has called it into existence.

The neutral gray tint of the walls gives a reposeful relief to the rich, but unshowy contents of the shelves, which occupy something like three-fifths the height of the room. On the east side is an attractive brick fire-place; the shelves run entirely around the room, with the exception of this space and that of the adjacent entrance, the two windows in the opposite wall, and the large window on the north, beneath which Professor Morse has his writing table. On the wall there hang a few Japanese pictures, the most attractive of which, and particularly interesting and instructive in this connection, is a long, panoramic water-color of a pottery, illustrative of the entire process of manufacture. It is the work of Bairai, a Japanese artist, author of a number of art works and a famous teacher of drawing in Kioto.



Key-note of the Collection.

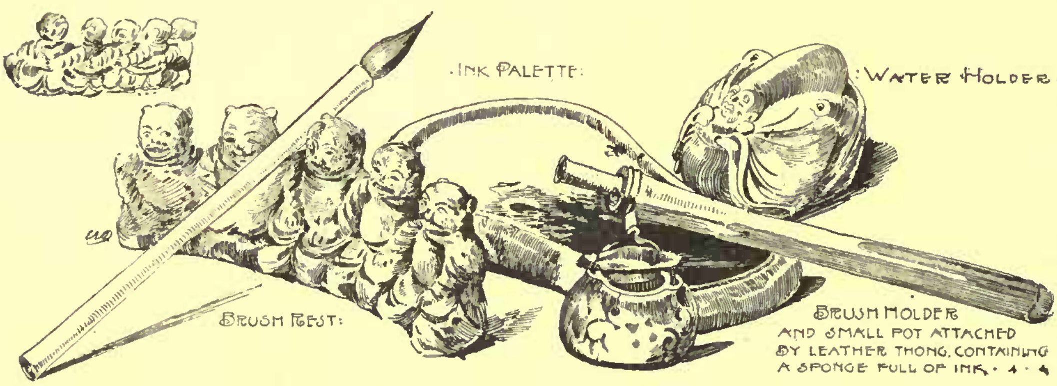


Wine Bottle, Bowl and Incense-box.
[The bowl shows how the design on the inside is part of design on the outside.]

It should be borne in mind that this is a collection of *pottery* only. Professor Morse first became interested in the subject through the study of the prehistoric pottery of Japan as a part of the researches instituted through his discovery and examination of the Omori shell-mounds near Tokio. The remains of primitive pottery found in these mounds necessitated a comparison with the prehistoric pottery of the country, and that, of course, led to further comparisons with the pottery, ancient and modern, of the present race; the prehistoric evidently having been the work of quite another people than the Japanese of to-day, who are not the aborigines of the country.



Furthermore, Professor Morse had felt obliged to seek some form of recreation as a diversion from arduous duties as professor of zoölogy at the Imperial University, and this ceramic study opportunely offered a pursuit most congenial to him. He soon perceived the remarkable opportunities of the rich field upon which he had casually entered, and he devoted his leisure time to it with characteristic ardor, bringing to bear the methods of a trained scientist. With the increase of his collection he was early impressed with the fact that the older forms, and even those pieces made within twenty years, differed in character from those made to-day. The recent work, with some important exceptions, showed unmistakably the influences of foreign intercourse. He observed still further that in many cases the old ways were very rapidly yielding to the new, and that, as a consequence of the rapidly-increasing use of porcelain, large numbers of provincial potteries were extinct, or dying out. This led him to expand the scope of his work far beyond the modest limits which he had assigned when he took it up, and he resolved, before it was too late, to make an exhaustive collection of the pottery of the empire, comprising its prehistoric, mediæval, and modern features. The task was a tremendous one, but with courageous resolution he set to work to obtain examples of every species of pottery known in Japan. The complete accomplishment of this was, of course, impossible, but his method and his opportunity enabled him to approach the realization of the ideal as but few men could.



Earthenware Drawing and Writing Utensils.

His scientific training, his experience as a collector in various fields of natural history from boyhood up, proved invaluable to him. He had acquired the habit of working unerringly forward on lines carefully laid out, forming a clear idea of his intentions at the outset, and following them unswervingly to the end. Therefore he collected his pottery precisely as a naturalist would collect species of insects or shells. If the object was new to him, he was not deterred by the price set upon it. As the ancient civilization of Japan has developed a class of antiquarians and connoisseurs who followed their fascinating inclinations with an enthusiasm and knowledge equal to that of any of their Occidental brethren, to obtain some of his most prized examples was a matter of no slight difficulty or expense.

Neither was he led to buy any piece simply because it was beautiful. This is a temptation which incessantly besets the collector in a field so intrinsically artistic as is that of ceramics; particularly when it happens to concern the work of one of the most artistic peoples in the world, and when the collector is a man of the artistic inclinations and talents of Professor Morse. If an artist had made the collection it would have been based on the considerations of beauty almost entirely, and its value would have been very slight in comparison with that which this possesses. Professor Morse would, however, as a naturalist, as soon have thought, when making a collection of shells, of choosing them for their qualities of luster, color, or grace of form, while his purpose was to draw from them the meanings of Nature in their creation and structure, as he would of allowing considerations of beauty to prevail in the choice of any of these examples of pottery, after he had once conceived his purpose of making this a representative collection.

But, while not seeking beauty, beauty has come to him in abundance. It has probably come even in a greater measure than it would if it had been his main object. For that which he sought was very largely beautiful. It represents one of the commonest products of a highly-æsthetic people, whose artistic nature could hardly help being applied thereto in a very great degree, and manifested in ways adapted to the qualities of the materials and the uses to which they were put. An artist in collecting would almost inevitably have been limited to a comparatively narrow range of forms and examples, such as would have brought themselves into his notice, but under the comprehensive scope adopted by Professor Morse, including every possible variety of pottery made throughout the empire — both in specimens and material employed, and period as well as method of manufacture — there has, as a matter of course, been brought together, incidentally to the main object, an uncommonly wide range of beautiful forms, colors, and designs. This collection, therefore, includes, as a feature of its scientific worth, a most thorough presentation of the artistic activity of the Japanese people as illustrated in their ceramic art, such as no collection made from a purely artistic standpoint would be able to show.

In forming this collection Professor Morse attempted to get specimens from every province where pottery was manufactured, and he also endeavored to secure every kind of object made in pottery. Other special efforts were to obtain every kind of "mark," whether stamped, incised, or painted, and also to get together, as far as possible, specimens showing chronological series of the leading types. The result of this has been the *most complete collection of Japanese pottery in the world*. There is not the slightest exaggeration in the statement that all the leading collections yet made would not, if combined, even distantly approach this collection in variety of objects, different provinces represented, numbers of makers, marks, etc. Other collections hitherto made have consisted chiefly of beautiful objects. It follows that in them are represented but few provinces and makers.

There are, to be sure, some exceptions. The Japanese collection at the South Kensington Museum, in London, for instance, was made with the express purpose of showing some of the features aimed at more comprehensively by Professor Morse. This collection, which was first exhibited at the Centennial Exhibition at Philadelphia, is extensively known through the excellent Art Hand-Book of the South Kensington series, edited by Mr. Franks, the Director of the British Museum. With the exception of the South Kensington collection, the various American and European collections of Japanese pottery consist almost wholly of specimens either remarkable solely for their beauty or their oddity — the grotesqueness which, in popular estimation, forms one of the main characteristics of Japanese art. Little do they know Japanese pottery, however, who judge it by such a standard.

Such questions as place, maker, and age are rarely considered in the formation of these collections, whose character may be realized by imagining a collector of etchings, for instance, who cared only for impressions remarkable for oddity or beauty, having no regard for the names of their artists nor the period of their production. A collection of this kind, while it might be attractive, would in no sense have educational or systematic value; it would be useless for either reference or study. A conception of the poverty of such collections arises upon the consultation of the beautiful work on Japanese marks and seals by Mr. Bowes, who must have had access to many private collections, and yet he gives only eighty-seven marks, embraced under five provinces, in the specimens of faïence represented. In the works of Audsley & Bowe on the "*Keramic Art of Japan*" there are described



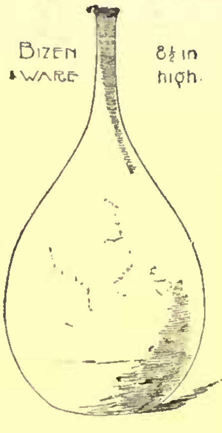
Example of Glazing.

but twenty-seven different wares from fourteen provinces. In the Morse collection are nearly four thousand specimens, with four hundred and fifty-five different marks, and over seven hundred different wares.

It is a fact that, with few exceptions, the public and private collections of Japanese pottery hitherto made represent no knowledge whatever of Japanese ceramic art, bric-à-brac dealers in Paris and London being the main sources through which they have been procured. Professor Morse's collection, however, was made by himself in the course of his various journeys in Japan, embracing provinces from the extreme north to the southermost portion of the Empire. His opportunities were, therefore, unrivalled, and it is hardly conceivable that a combination of circumstances so favorable could occur again. In the first place, as a pioneer in the task, he had the full reaping of a field from which followers in the same line must content themselves with gleanings. Moreover, Professor Morse enjoyed exceptional opportunities of coming into contact with the best sources, while his sympathetic and companionable personality, imparting his own enthusiasm to those with whom his searches brought him into contact and enkindling them with the desire to forward his work, was not one of the least factors in his success. Thereto must again be reckoned his scientific qualifications which enabled him to know just what he wanted and direct himself almost unerringly to the very place where it was to be found. The duplication of this collection, or the formation of one equally representative, would be a contingency so remote that it may safely be set down as an impossibility. Even were it possible, it would necessitate an expenditure so great that the value set upon this collection would be trifling in comparison.

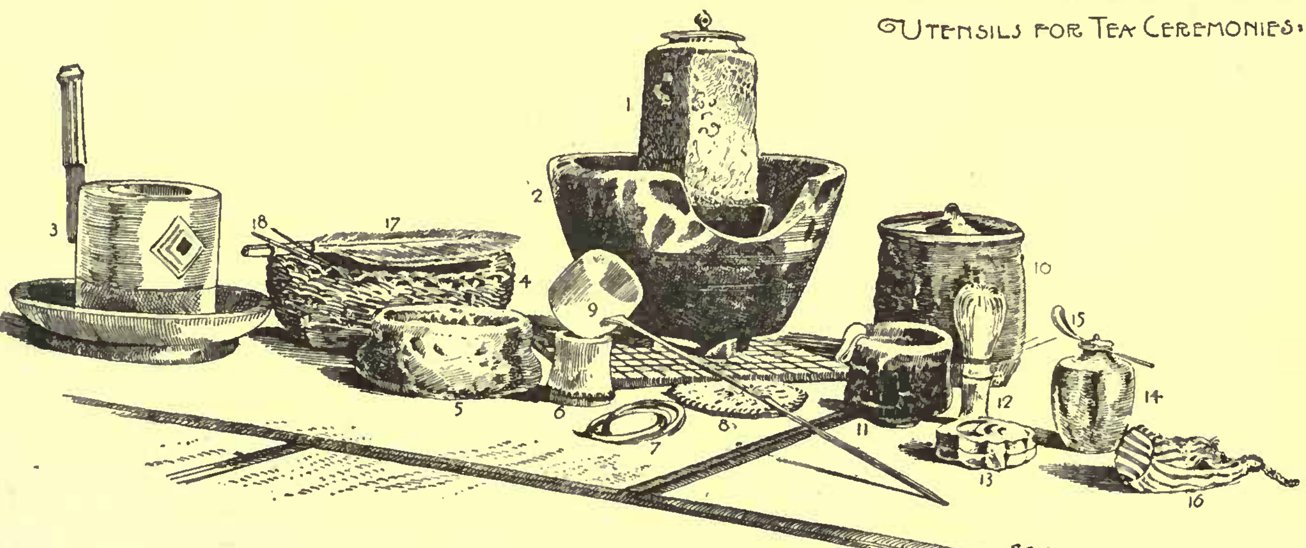
A few items may give a slight idea of the richness of this collection. Nearly two thousand of these specimens were identified by the late Ninagawa Noritane, the famous Japanese antiquarian and author of the beautiful illustrated work on pottery, entitled "*Kwan ko dzu setsu*," a superb example of native reproductive art and typography, its colored lithographs being strikingly accurate copies of the originals, both in drawing and in delicacy of color. Professor Morse has, marvellous words of the author of "*Some Chinese Ghosts*," Lafcadio Hearn, in his "*Tale of the Porcelain God*," describing the making of a wondrous vase counterfeiting "flesh moved by the utterance of a Word, creeping to the titillation of a Thought."

The importance of pottery in forming an estimate of the Japanese may be seen from the fact that it stands at the head of their arts, a reputation as an amateur potter being the acme of artistic merit, while the wealthy men of *leisure and refined tastes* delight to employ themselves in the amateur potteries which they have built attached to their homes.



Form to be expected in porcelain rather than earthenware.

Probably no institution has had a profounder influence upon the pottery of the Japanese, as upon many other arts of that people, that the peculiar tea-ceremonies, for which particular rooms or buildings are set apart, constructed expressly for the purpose. As Professor Morse says, a volume might be filled with a description of the various forms of buildings connected with these observances; and, indeed, another volume might be filled with the minor details associated with their different schools. The party comes about by the host inviting a company of four to attend the tea-ceremony, and in their presence making the tea in a bowl after certain prescribed forms, and offering it to the guests. It seems as if a ceremony of this description must have had a religious origin, but it is said to be based purely upon etiquette. Many books, Professor Morse tells us, are devoted to the exposition of the different schools of the ceremony, illustrated with diagrams showing the various ways of placing the utensils, plans of the tea-rooms, and all the details involved in the observances. In his delightful volume, "*Japanese Homes and their Surroundings*," he says of them: "Particularly have they affected the pottery of Japan; for the rigid simplicity, approaching



1. Iron kettle. 2. Earthenware furnace. 3. Mill. 4. Charcoal basket. 5. Slop-bowl. 6. Rest for kettle-lid. 7. Rings to lift kettle. 8. Bamboo mat to rest kettle on. 9. Bamboo dipper. 10. Water jar. 11. Tea bowl. 12. Bamboo stirrer. 13. Incense box. 14. Tea jar. 15. Teaspoon (bamboo). 16. Bag for tea jar. 17. Feather duster. 18. Tongs.

with few exceptions, every kind of ware described in Ninagawa's work; he possesses thirty of the original specimens figured therein, and also thirteen of the original specimens figured in the unpublished plates of that author.

After the death of Ninagawa, Professor Morse employed Mr. Kohitsu, an expert in the National Museum at Tokio, to assist him in the identification of his collections, and was in frequent consultation with a number of other pottery experts. He possesses a rare treasure in the shape of Ninagawa's annotated copy of his work, besides many of his original drawings, notes, memoranda, etc., and he has adopted every possible measure to ascertain correctly the history of each piece as conveyed by the locality of its origin, the identity of its maker, and its age; he has also sought to interpret every mark. In consequence, the collection is in the most perfect order, and classified according to the provinces and kinds of pottery.

Whoever should expect to see in this collection a kaleidoscopic and dazzling array of color, with all manner of elaborate design and strange form, will be disappointed. It does not attack the eye; it quietly, gradually absorbs the attention of the beholder whose senses are capable of the appreciation of subtleties of tone and grace of form. It affords a revelation of the exquisite æsthetic taste of the Japanese people. There are probably very few of us, if there be any, who are capable of fully realizing the pleasure which a Japanese connoisseur would have in going over these examples; noting the hardly-perceptible *nuances* of color, or the delicious qualities of the various glazes which, as the hand caresses them, impart new ideas of the æsthetic capabilities of the sense of touch, almost realizing the an affected roughness and poverty, which characterizes the tea-room and many of the utensils used in the ceremony, has left its impress upon many forms of pottery. It has also had an influence on even the few rustic and simple adornments allowed in the room, and has held its sway over the gardens, gateways, and fences surrounding the house. Indeed, it has had an effect on the Japanese almost equal to that of Calvinistic doctrines on the early Puritans. The one suppressed the exuberance of an art-loving people, and brought many of their decorative impulses down to a restful purity and simplicity; but in the case of the Puritans and their immediate descendants, who had but little of the art-spirit to spare, their sombre dogmas crushed the little love for art that might have dawned, and rendered intolerably woful and sepulchral the lives and homes of our ancestors."

The rules of these ceremonies forbid any conversation on worldly subjects, such as politics or scandal; flattery is also forbidden, and no distinction of rank is observed. Usage forbids the meeting to last over two hours.

Among the pottery utensils used in the tea-ceremony are the furnace, water-vessel, jar to hold the powdered tea, pan for ashes and tea-bowl. The furnace varies somewhat in form, generally consisting of a vessel on three legs; in the upper part is an opening to create a draft, and in this upper part rests an iron vessel for boiling water, with two handles and a lid. The water-vase, holding the water for replenishing the supply for the utensils, is generally rudely made, and often provided with a lacquer cover. The tea-jar, one of the most treasured objects, is usually small and oviform, of hard

pottery, decorated simply with a mottled glaze, and having a flat ivory lid. It is often encased in a rich brocade bag, sometimes again enclosed in a lacquer box, with a coarser outer bag enfolding it. The tea-bowl is purposely made very rudely, somewhat varied in shape, sometimes shallow like a saucer, and again nearly cylindrical. Extreme care is taken to have the edges smooth to the lips. The decoration is very slight. The ash-pan is shallow, of unglazed ware, and with edge curved inwards. The use of incense forms part of the tea-ceremony. The incense-boxes are of varied forms, and usually small in size. The incense-holder exhibits considerable variety, and is sometimes made in the forms of men, beasts, or birds.

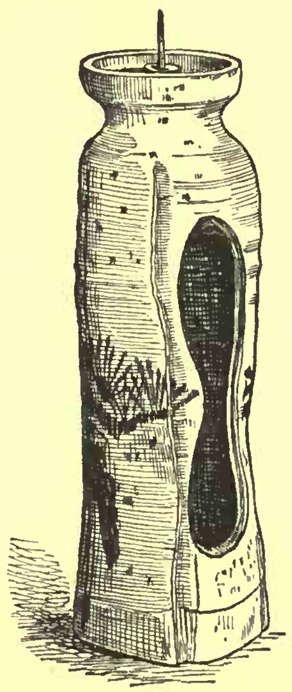
Other objects which the Japanese make in pottery are as follows: The fire-holder — from which the smoker of tobacco lights his pipe — a vessel of usually small size, and cylindrical in form. A small earthen brazier, somewhat pear-shaped and with an opening on one side, is used for keeping the hands warm. It is sometimes very grotesquely shaped. Pottery objects are used at the writing-table, consisting of small ornamented screens, used as paper-weights, vases for washing the brushes or pencils used in writing, vases for holding them, and small closed vessels for supplying water to the ink-stand. These water-vessels are very diverse in form, always with a diminutive spout to allow the water to issue drop by drop, and a small hole on which to place the finger to regulate the flow.

The vessels for saké, the intoxicating liquor distilled from rice, are chiefly bottles, either square, round, or polygonal, and jugs with spouts something like kettles or tea-pots.

Tea-pots exhibit two forms; one like the ordinary European vessel and the other with a hollow handle at right-angles to the spout, introduced in the fifteenth century. The tea-cups are in the ordinary form, without handles, and when there is a saucer it serves only as a stand for the cup. Plates and dishes used at meals are chiefly saucer-shaped, and when the flat edge is



Flower-vasa decorated with the stump of a cherry branch.



A Candlestick of Akatsu ware. [From "*Japanese Homes and their Surroundings.*"]

used it is an innovation to suit European habits. Rice is eaten in small bowls, and small saucers are used to hold comfits. Cake-boxes are made of pottery in a great variety of forms. Coarse pottery is used for all kinds of kitchen utensils, and also for gardening and agricultural purposes.

All these forms are to be found in great variety in the Morse collection, as well as many used for more particularly ornamental purposes. One of the most interesting classes is that of the flower-vases; the Japanese people, like nearly all Orientals, delighting ardently in flowers. Their flower-vases are given a remarkable variety of form, often exceedingly picturesque. They never sin in the common Occidental direction of giving flower-vases strong colors, for they are aware that such a proceeding would impair their object as hardly anything else would, robbing the flowers themselves of much of their effect. They invariably make their flower-vases with inconspicuous neutral colors, and, when not in conventional shape, the vase usually is designed to suggest, when in use, an association of the flowers with some natural object, as a tree-stump, a section of its trunk, a twig, or branch; a section of bamboo, etc. This natural effect is aided by the habit of disposing the flowers, which is usually in single sprays or blossoms. They are rarely crowded in masses. The flowers are recognized as the chief objects of interest, and the vases are so used as to strengthen their effect. The neutral tones of the vases materially assist in carrying the attention to the beauty or brilliancy of the flowers, and, when it is diverted to the picturesque form of the vase, it is again led to a contemplation of that which seems to be the outcome thereof.

Nearly all the Ceramic wares from Japan which interest us by their intensely "decorative" design and ornamentation do not represent Japanese tastes in the least. They are made solely for the European and American markets, and are contemptuously regarded by their manufacturers as meretricious, only serving to meet the demand of depraved and vulgar tastes!

A marked feature of the collection is the very subordinate place occupied by decorative ornament. In most cases it is merely incidental, its purpose evidently being to reinforce or complete the impression conveyed by qualities of form and color. For æsthetic effect the main reliance appears to be the subtile qualities of color-tones, and delicate distinctions in the methods of glazing. Even a superficial acquaintance with the collection makes it conceivable to an appreciative visitor what rare measures of delight may be obtained by the trained connoisseur in the examination of these manifold qualities of tone and texture; for instance, recognizing in the peculiar glazing of some diminutive tea-jar the consummate skill of a famous artist whose hand has given it a classic value, making it as precious as a jewel. Distinctive qualities of worth may be detected in the disposition of the glaze, apparently spilled carelessly over the upper portion of the vessel and trickling down over the lower part which betrays the nature of the raw material — the glaze terminating irregularly and fringe-like — recalling rain-drops and tears in their semi-translucent pearliness. Then there are the exquisite gradations of coloring — faint flushes and indeterminate suggestions of yellows, greens and pinks, and the indescribable variations and comminglings of blues and grays. Again, the many effects of density or lightness in the composition of the glaze, sometimes, for instance, filled with thousands of tiny bubbles, like sparkling water.

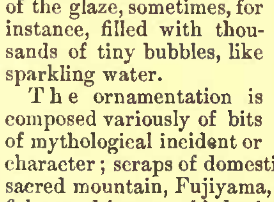


A fictile Tour de force.

The ornamentation is composed variously of bits of mythological incident or character; scraps of domestic scenes; glimpses of landscape, with the sacred mountain, Fujiyama, frequently appearing; figures of animals, fishes and insects; birds singly or in flocks, with, of course, the stork one of the most commonly represented; the five monstrous animals of mythology, the dragon, the phœnix, the kyrin (a combination of deer and bull, with a horn on its forehead), a lion monster, and the sacred tortoise with a hairy tail; while trees, plants, grasses and flowers are used with remarkable vigor and grace. Of the trees the pine, the bamboo and the plum are in particular favor, and commonly appear in combination. These, collectively known under a modification of their Chinese names as *sho chiku bai*, form an emblem of longevity.

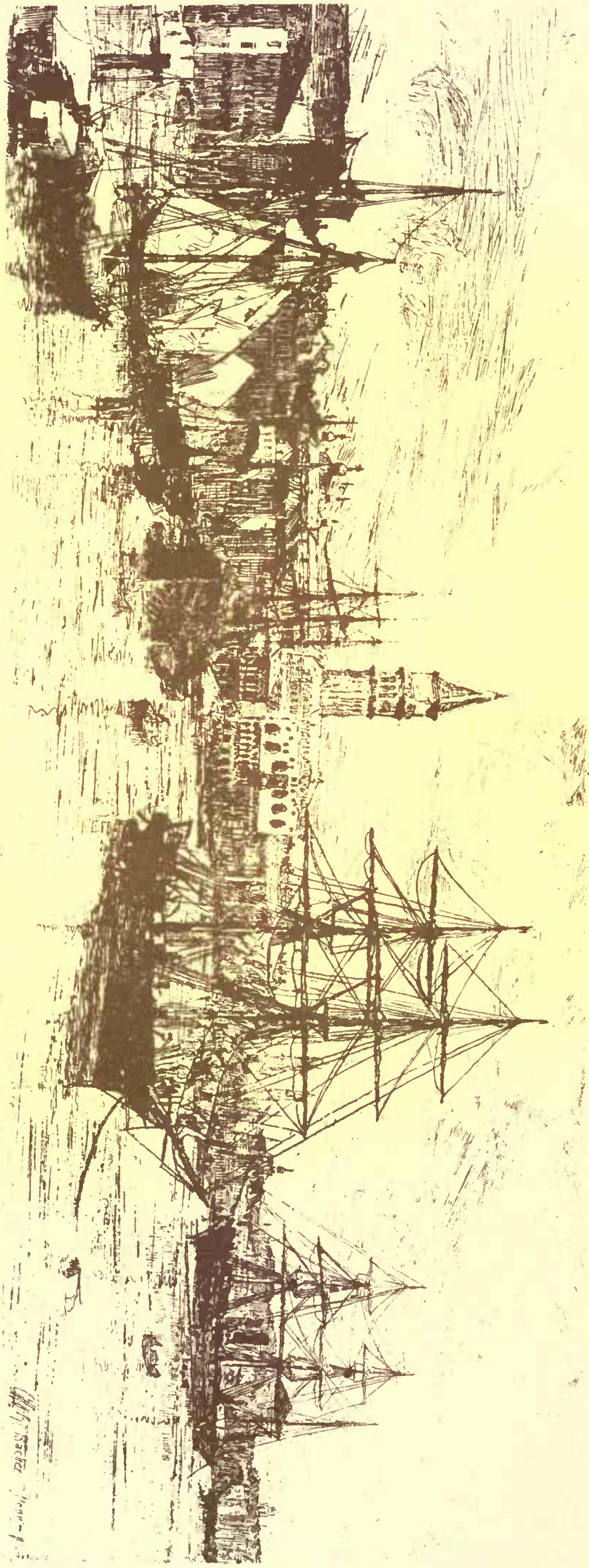
This combination of pine, plum and bamboo is notably found on all the Tosa bowls in the Morse collection. A noteworthy decoration of pottery designed for birthday gifts is a lobster, the significance of which is that it conveys the wish, "May you live to the age when your back becomes as round as this lobster's!"

Of flowers, most frequent are the sacred lotus — an emblem of Buddha, the chrysanthemum, the iris and the peony. The chrysanthemum, forming the imperial emblem of Japan, is very familiar in a conventionalized pattern, having little resemblance to the natural flower. It is hardly necessary to call attention to the peculiarity of the Japanese in disposing their designs in strange-shaped panels, often overlapping; and occupying spare spaces and borders with diapers of manifold variety, including the Greek fret and other classic patterns. Among the ornaments are often conspicuous some of the badges of the Japanese heraldry, as that of the family of the Mikado, the three leaves and flowers of the *Paulownia imperialis*, known in Japanese as the *kiri-mon*, treated conventionally, and the emblems of various other noble families.



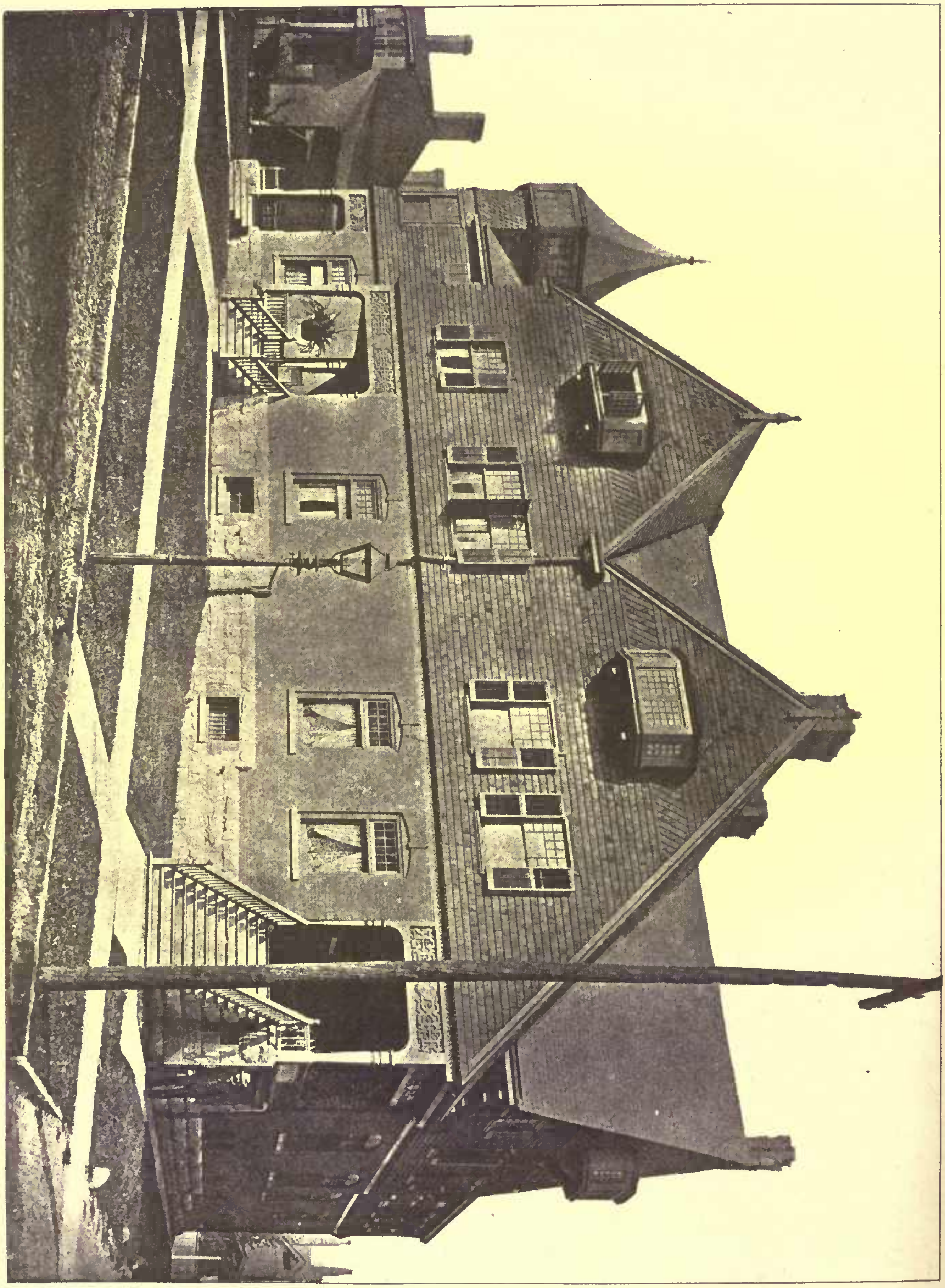
A notable bit of decoration upon one of Professor Morse's pieces, over a century old, forms a token of the old Dutch influence, when that nation enjoyed the monopoly of intercourse with the Island Empire. It is a Japanese imitation of one of the old Dutch landscapes familiar to us on blue china, and it is interesting to perceive how the prosaic Dutch character of the original has been resolved into Japanese grace in the interpretation.

The Japanese treatment of fractured pottery is characteristic. They scorn the idea of attempting to conceal the fact that a piece has been broken. They mend it carefully, and then accentuate the fact of mending by tracing along the lines of fracture narrow bands of gold, silver, or other color, usually red. These irregular, and often branching or zigzag marks have the effect of intentional decoration, quite in accord with the apparently casual methods of Japanese ornamentation. Few persons not knowing this would



Venice by [illegible]

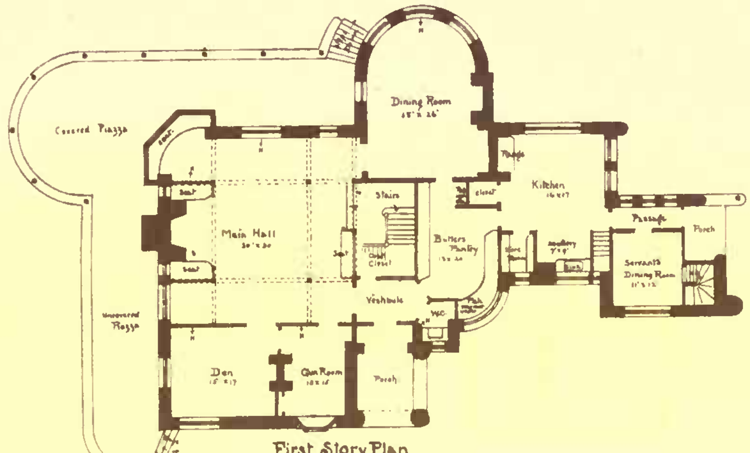
Heliotype Printing Co Boston.



Houses for Mrs. Cole, Cleveland O. C O Arey. Architect.

Heliotype Printing Co Boston.

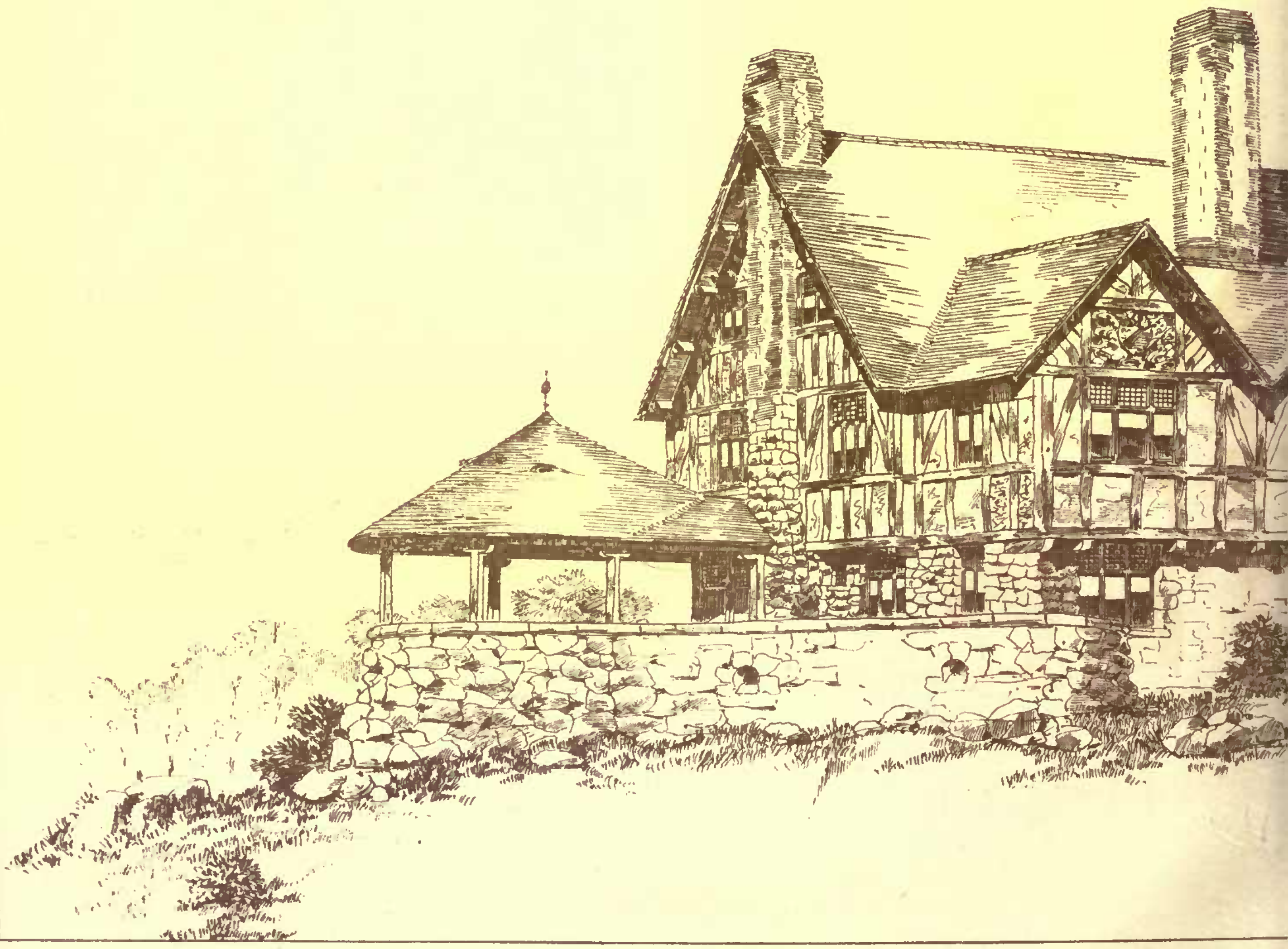
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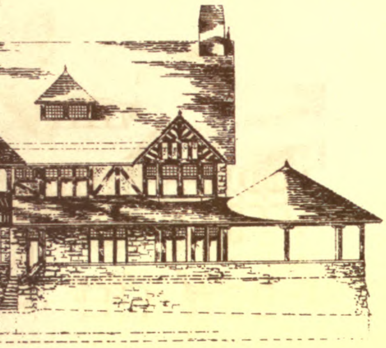


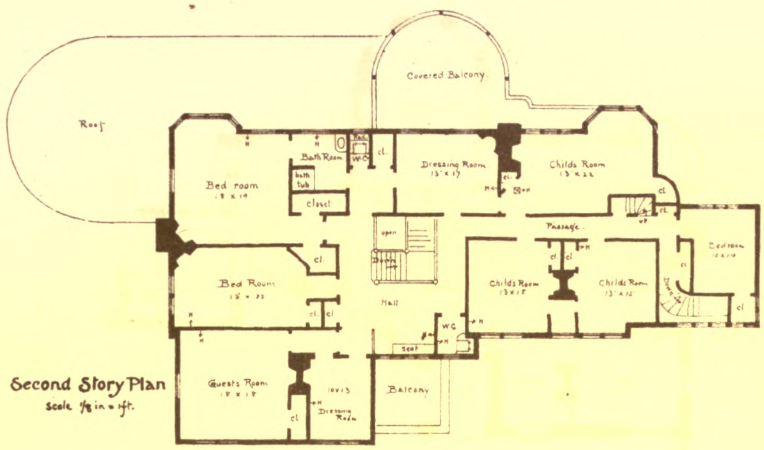
First Story Plan

Scale 1/8 in = 1 ft.









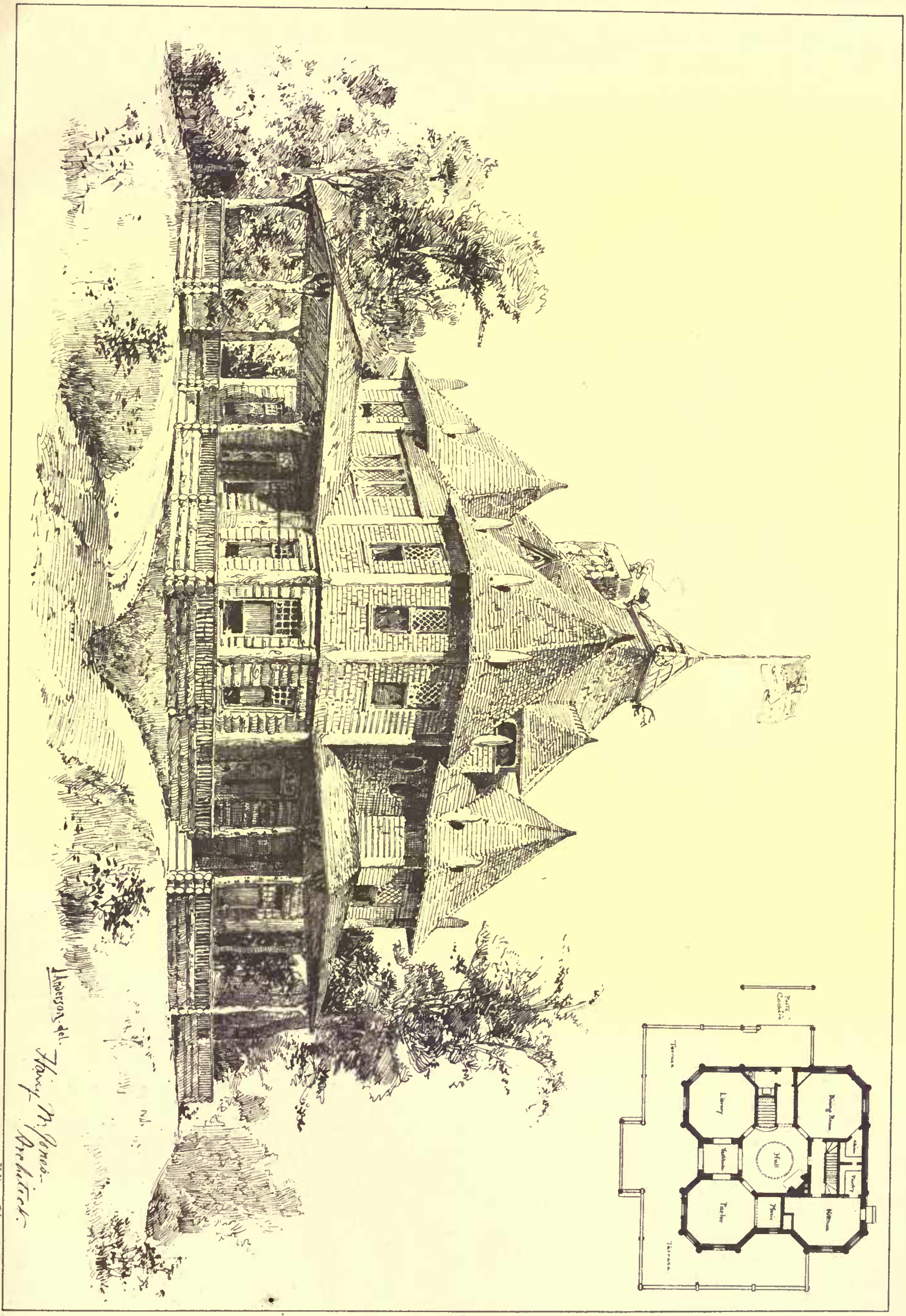
Second Story Plan
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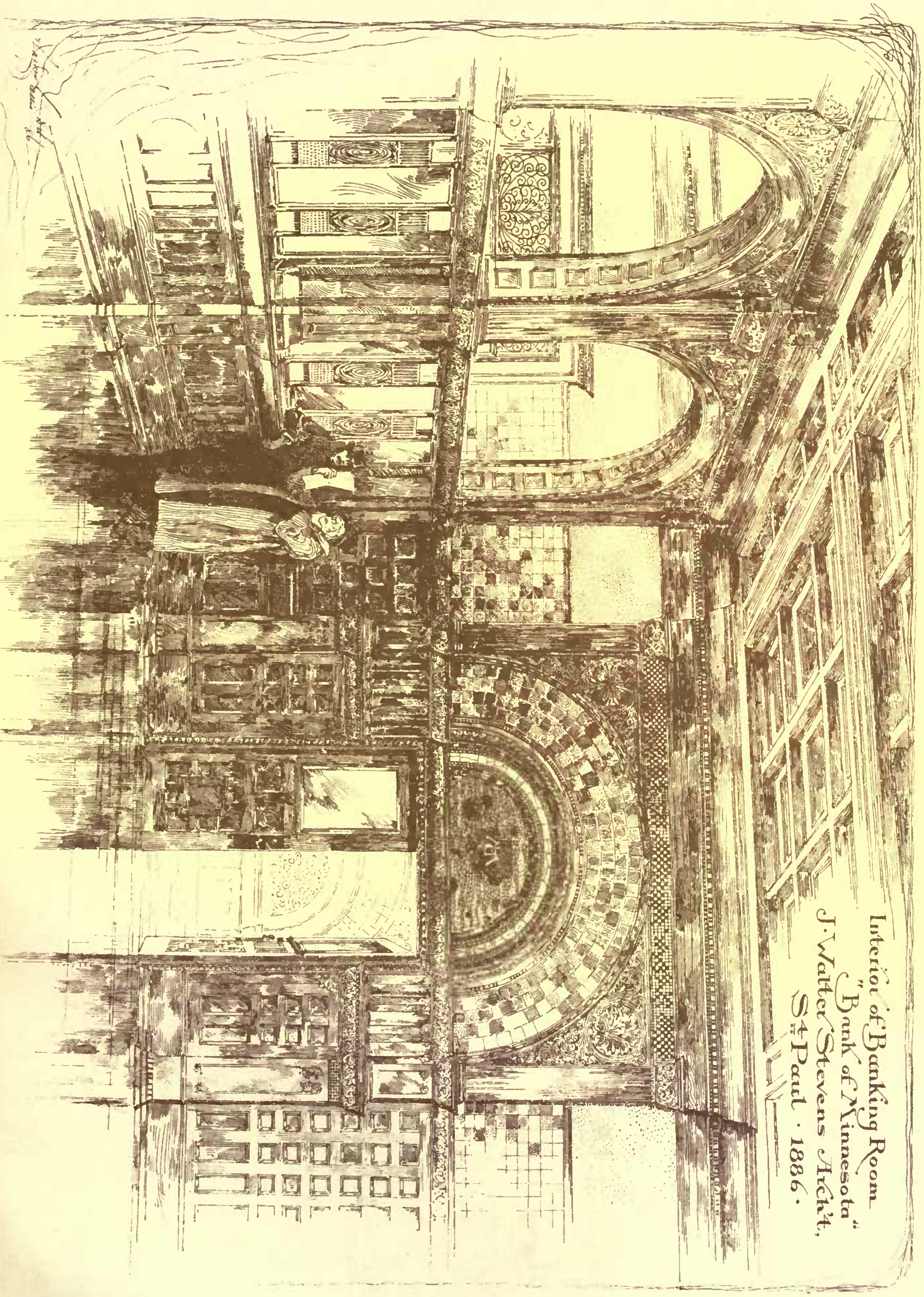
Shooting Box at Tuxedo Park, N.Y.
for James Lawrenee Breese Esq.

R. R. Robertson, Architeet.
121 E. 23d St. N.Y.

Heliotype Printing Co. Boston.



Heliotype Printing Co. Boston.



Interior of Banking Room "Bank of Minnesota" J. Walter Stevens Arch't, St. Paul · 1886 ·

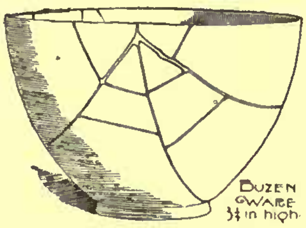
detect the real purpose of these lines. A mended piece, instead of imparting a shock of disappointment to the beholder when at last he detects a cunning concealment, at once frankly confesses its defect, which thus appears transformed into a virtue, as the lines often heighten the beauty, and the worth of a valuable old piece does not appear to be impaired thereby.



Edge of dish mended with lacquer.

There is, of course, a great variety of marks. Dates are more infrequent than with the Chinese, but the *nengo* is occasionally found, like the Chinese *ni enhao*, as an arbitrary name for the reign, or portion of the reign, of an emperor.

Japanese pottery is designated by the name of the province, by the name of the city or town of its manufacture, of some district or particular street in a city, by some poetical or sentimental name, as that of the garden in which the pottery is situated, or most common of all, by the name of the maker. It thus follows exactly the same lines adopted in the naming of our Occidental pottery and porcelain. The Rookwood pottery, for instance, illustrates the poetical designation with us, Rookwood having been the name of the suburban estate near Cincinnati where that famous factory is situated.



Bowl mended with gold lacquer.

The name of the potter is, however, the most common of Japanese marks. This is unlike the Chinese custom, and is ascribed to the individual character which the Japanese maker gives to his wares. The Japanese pottery is small in size, and while in China every piece passes through the hands of a number of workmen, so that no piece could be marked as the work of one man, in Japan the small factory is carried on by a single potter and his family, in the house where he lives, so that he has a pride in putting his name to his wares as a guaranty. This is a particular characteristic of the older wares, made chiefly for home markets. The mark is sometimes scratched, sometimes stamped with a seal, and sometimes painted. Some of the princes occasionally bestowed upon famous potters special seals to be used on their wares.

Some idea of the extent of the Morse collection may be obtained from a comparison with the few large collections of wares whose catalogues have been published. The best known catalogue is that already mentioned, made for the South Kensington Museum by Mr. Augustus W. Franks. This catalogue, as we have seen, forms one of the South Kensington Art Hand-Books, and to it the writer is indebted for much of the technical information which has been here presented. The Japanese made this collection specially for display at the Philadelphia Centennial Exhibition at the suggestion of the South Kensington authorities, their museum to be its ultimate destination. The excellent catalogue of Mr. Franks has given the collection a reputation almost classical. That portion represented by faïence and soft earthenware contains forty-eight different marks representing fifteen provinces.

Another celebrated collection, that made by Captain Brinkley, a catalogue of which was published by Mr. Greey of New York, possessed in its faïence sixty-one different marks representing twelve provinces.

The Morse collection contains over 700 different marks, representing thirty-five provinces. To exhibit the contrast in another way,


Lamp — Akatsu ware.
[From "*Japanese Homes and their Surroundings.*"]

the South Kensington catalogue records 65 kinds of pottery representing 24 provinces. The Brinkley catalogue records 81 kinds of pottery representing 22 provinces. The Morse collection possesses over 400 kinds of pottery representing 54 provinces. Regarding the number of specimens of faïence, the South Kensington catalogue records 167 specimens; the Brinkley catalogue, 296; and the Morse collection contains nearly 4,000. The Brinkley catalogue notes 39 specimens of faïence from the collection of the famous antiquarian, Ninagawa Noritane. The Morse collection has 420 specimens from the same source.

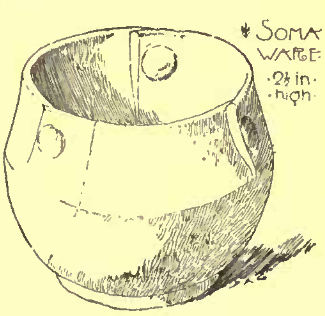
The late Louis Agassiz laid down the maxim that in studying a species the student must have before him an abundance of specimens. This maxim is equally true in regard to Japanese pottery. In order to become familiar with the pottery of any maker, one must have examples of his early as well as his later works. And this necessity becomes all the greater when one undertakes to gain a familiarity with Japanese pottery under the larger groups of classification by provinces, as when we speak of Tamba, Higo, Satsuma and the like, for under these names are included many quarries, potteries and periods.

In no way can the wealth of material in the Morse collection be appreciated better than by comparing the number of his pieces under provincial grouping with the South Kensington and Brinkley collections, as shown in their respective catalogues. It must be remembered that porcelain is not included in any of these enumerations, and it should also be borne in mind that, with few exceptions, only the more important and attractive pieces are included in the numbers given for the Morse collection. The following table tells the story:

PROVINCE.	So. Kensington.	Brinkley.	Morse.
Awaji	5	5	35
Bizen	16	11	83
Buzen	0	1	17
Chikuzen	6	10	124
Echizen	0	1	4
Harima	0	1	59
Higo	4	9	94
Hizen	7	1	149
Idsumi	1	0	17
Idsumo	9	10	61
Iga	3	0	51
Ise	5	12	140
Iwaki	3	1	64
Kaga	8	37	62
Kii	1	6	39
Musashi	9	3	90
Nagato	5	0	56
Omi	5	4	125
Owari	11	21	615
Satsuma	12	30	169
Settsu	4	1	58
Tamba	2	3	81
Tosa	1	1	21
Totomi	1	1	49
Yamato	2	4	65
Yamashiro	41	139	542

And of many other provinces of which the first two catalogues possess no example we have in the Morse collection, notably Sanuki, 26; Aki, 19; Suwo, 37; Chikugo, 9; Tsushima, 10, etc.

It is to be hoped that this almost invaluable collection may be guarded against the danger of accidental destruction, or an almost equally deplorable destruction through dispersal, by such public-spirited action on the part of some of our many persons of means and beneficent disposition as would secure it for some institution where it might remain safe in its entirety, accessible to the people at large. Not to mention its value as the most complete instrumentality for the study of one of the most important aspects of Japanese art, its worth as an educational means for our own people is almost beyond calculation. Professor Morse is frequently applied to by art students, and by those technically interested, for permission to make studies of certain examples. For instance, the celebrated Rookwood pottery at Cincinnati, the leading art-pottery of the United States, sent to Salem one of its most talented designers, who spent several days in making drawings of a few attractive pieces, and even Japanese artists have come expressly to make studies of some rare examples, the like of which could not be found at home, to be sent back to serve as models for native manufacture. The great art tile-works of J. G. & J. F. Low at Chelsea have also obtained numerous hints from this collection for some of their best designs.



A Potter's Freak.

In the collection at South Kensington, the visitor may notice here and there a vacancy, with a card in the place of some specimen, bearing such words as "Loaned to the Wedgewood Pottery," or some other well-known factory of the kind. One of the rarest examples may be absent for two or three months, undergoing close study at the hands of artisans, and thus effecting a permanent influence on English ceramic art. With this vastly superior collection made similarly accessible to the public, and particularly to those more nearly interested, and with the growth of our art-industries, its influence and value would be inestimable. SYLVESTER BAXTER.

DECENNIAL INDEX OF ILLUSTRATIONS. — We have in course of preparation a classified index of the illustrations published in the *American Architect* from 1876 to 1885 inclusive. We find that in very many cases the *cost* of the building has not been stated and we, therefore, ask our contributors to furnish us the approximate cost of such buildings of their designing as have been published during the above named years.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

SOUTH SIDE OF MAIN ROOM, CONTAINING PROF. E. S. MORSE'S COLLECTION OF JAPANESE POTTERY.

[Gelatine Print, issued only with the Imperial and Gelatine Editions.]

FOR description see article elsewhere in this issue.

VENICE BY DAY. AFTER AN ETCHING BY OTTO H. BACHER.

ALTHOUGH Mr. Bacher is but little over thirty (having been born at Cleveland, O., in 1856), he has won fame both at home and abroad. Elected a Fellow of the Society of Painter-Etchers, praised by Seymour Haden, called by the *Times* "a most formidable rival" of Mr. Whistler and likened by the *Saturday Review* to Meryon, his talent was readily recognized. He began to etch in the intervals of painting some ten years ago, and studied in Munich, and later in Venice, with Duveneck, and several other young American artists, who were much influenced by Whistler, then etching his "impressions" of the "Bride of the Sea." His plates are usually of moderate size and represent almost entirely either scenes in Germany or Italy. He has executed a number of etchings of Venice, and has lately completed a large plate of a view of Milan Cathedral.

HOUSE FOR MRS. MEAD, WASHBURN PARK, MINNEAPOLIS, MINN. MR. H. W. JONES, ARCHITECT, MINNEAPOLIS, MINN.

THIS house is to be built of logs for the first story, with rusticated shingles on the second story and roof, and to be treated with creosote stain. The octagonal hall in the centre of the house is to be finished in rustic oak, with the bark taken off, and the wood filled with dark filling, and to be polished. The fireplace in hall will be of round boulders, with oak shelf and panelling above of oak logs; the hall will run up two stories and have a circular balcony around it at second story, and be lighted from the top. The parlor and music alcove will be finished in white enamel with colonial detail. The cost will be about $12,000.

HOUSES FOR MRS. COLE, CLEVELAND, O. MR. CLARENCE O. AREY, ARCHITECT, CLEVELAND, O.

THESE houses were finished last spring at a cost of $17,000, including mantels, ten in all, gas-fixtures, furnaces and interior decoration. The houses were finished in natural pine, except the mantels and stairways, which were of hard wood. Some of the rooms were painted and stenciled simply, and others were papered.

SHOOTING-BOX AT TUXEDO PARK, NEW YORK. MR. R. H. ROBERTSON, ARCHITECT, NEW YORK, N. Y.

BANKING-ROOM, BANK OF MINNESOTA, ST. PAUL, MINN. MR. J. W. STEVENS, ARCHITECT, ST. PAUL, MINN.

NEW MATERIALS AND INVENTIONS.[1]



IN treating such subjects as new inventions connected with building operations and architecture before an assembly of practical men, it may be as well to state at the outset that there are three things which it will be impossible for me to do. First, I cannot attempt to notice all the varied new inventions which the last few years have brought to light; secondly, I cannot avoid describing some inventions which are not new to many here; and thirdly, I cannot help omitting some which, in the opinion of many persons, are superior in interest to those which I shall describe. All that I can hope to do is — taking my own personal experience as a guide — to bring before your notice certain comparatively modern inventions which have interested me either on account of their ingenuity or of their practical usefulness. It must be borne in mind that it takes a very considerable time before a new invention becomes so well known and its utility so thoroughly recognized for its use to become almost universal; and, moreover, no one has a right to recommend the employment of new methods simply because they are new; a certain amount of experience of them is necessary first, and this experience can only be obtained in time.

I believe it is just twelve years since a paper on this subject was read in this room by Professor Roger Smith, and it is curious to notice that some of the novelties which he called attention to then remain almost novelties still, so conservative are we in matters connected with building. Our cousins across the water are far more inventive than we are, and I have had to go to them for several of the novelties which I shall bring before you. The American intellect seems to take nothing for granted, to look upon nothing as final, and to bend its whole endeavors to find out some way of improving any mechanical operation which has for some time been in use.

I think new inventions and discoveries are rarer in the domain of architecture than in other branches of industry, and for this reason: all new invention must be in a mechanical direction towards saving of labor, and as the best building has as much art about it as science, and as art cares far more for the variety obtained by individual effort than for the precision and exactness of mechanical repetition, architects (who, after all, exercise far more influence indirectly upon building than is sometimes imagined) are disposed to look somewhat shyly upon the facilities for doing away with individual labor, and to decry the reproduction of ornamental features by mechanical means. We are inclined to agree with Mr. Ruskin and to prefer a tiny bit of carving into which the workman has put his head and his heart, as well as his fingers, to any number of yards of machine-made moulding. And, within certain limits, we are right in this preference. But when we turn from the purely artistic to the practical and scientific side of architecture, we cannot be blind to the immense advantages which modern scientific discoveries give us over our forefathers, and we should be foolish if we did not make use of them.

Take, for example, the use of iron in building. It has completely revolutionized our methods, and enables us to economize space and to erect buildings in positions where it would have been impossible to do so without its employment. And it is for the architect to take any new materials which assert their structural superiority, and to adapt them to artistic forms and treatment, and granting the requisite ability, I do not believe there is anything that cannot be "invested with artistic merit," to use a phrase which we heard a good deal of a year or two ago, even though it be so utilitarian and, to most of us, utterly detestable, as a cast-iron front to a warehouse.

My remarks this evening must necessarily be somewhat unconnected, for the reason that the inventions which I have to describe have little or no connection with each other, but I will endeavor to work as much as possible upon the lines of our own specifications, that is, from the more purely constructive to the decorative portion of a builder's work.

We are all of us now so thoroughly imbued with the necessity of properly trapping and ventilating house-drains, and cutting them off from the sewers, that it is scarcely necessary to allude to these matters at all; but in connection with sanitation there is one discovery that has been made comparatively recently that demands a word or two of notice. I allude to the unsealing of traps. It used to be considered sufficient, if closets were trapped, to ventilate the soil-pipe alone, but the experiments made in the United States, at the instance of the Washington National Board of Health, and in this country by Mr. Stevens Hellyer, have proved to absolute demonstration that unless the traps themselves are ventilated they will be liable to be unsealed. There are two ways by which traps can be unsealed: first, by the momentum of any discharge passing through the trap itself; secondly, by the passage of a considerable quantity of water through a pipe with which the trap is connected. The passage of this water causes a momentary vacuum, by means of which the water is sucked out of the trap, and it is absolutely necessary, if the trap is to be a safe one, that all the trap-branches into the main pipe should have an ample ventilating-pipe carried up from them and branched into the main pipe above the point where the highest trap-branch enters it. This important fact cannot be too widely known, as it is certainly still the exception rather than the rule to have these branches ventilated.

Before passing from the subject of drains and pipes, I should mention that increased experience all seems to point to the desirability of decreasing rather than enlarging the size of pipes; four-inch glazed earthenware pipes for house-drains, and three-and-a-half-inch lead pipes for soil-pipes, if properly connected and laid, will suffice for all purposes, and will keep much cleaner than those of larger bore, always supposing they are properly flushed out. In fact, Mr. Hellyer has used soil-pipes of no more than two-and-a-half inches in diameter.

I do not think I need occupy your time in describing concrete as a building material, as there has been more than one evening in the last few years devoted to the subject, nor shall I attempt to enumerate the various kinds of ornamental bricks for walls which are now produced by various manufacturers, of excellent quality and design. I will merely ask you to examine two comparatively recent forms of concrete paving — Stewart's granolithic and what is called the "impenetrable" paving, both of which appear to me to be excellent.

Terra-cotta also is so well known to all of you, and its usefulness as a building material is so thoroughly established that I need not detain you on this subject further than to mention a new form of nosing for stone or concrete steps invented by Messrs. Doulton. This is called the silicon tread, and is a kind of terra-cotta, *i. e.*, clay burnt as hard as it is possible to bake it. These treads were used for three years at the recent exhibitions at South Kensington, and must have had several millions of persons passing over them.

There is one comparatively recent invention, somewhat in the nature of brick, which is not, I think, so well known as it deserves to be. The impossibility of getting good fixing to ordinary brick walls has necessitated the use of wood bricks or plugs, which have two drawbacks: (1) that they are liable to shrink, and therefore lose

[1] A paper by Mr. John Slater, read at the Eighth General Conference of Architects held under the auspices of the Royal Institute of British Architects, May 4.

their hold on a wall; and (2) that they are certain sooner or later to decay. Mr. Wright has endeavored, with much success, to get over this difficulty by making what he calls "coke-breeze fixing blocks." These are made of the same size as an ordinary brick, and can be built in the walls wherever required, and their constitution is such that they will hold nails as well as wood. For the purpose of fixing skirtings, dados, and linings of all kinds on the interiors of brick walls, I consider them admirable, and even more useful are they for external use if a portion of a wall is to be hung with tiles. Every one knows how unsatisfactory wooden fillets are in such situations, as they are certain to get rotten before long, but these coke-breeze blocks are practically indestructible. Another method of using them is when wooden floor-boards are required over a concrete floor, as they obviate the necessity of bedding wood blocks in the concrete, a plan which never commended itself to my mind.

The next subject to which I shall ask your attention is that of fireproof construction. The enormous losses which such huge conflagrations as have been seen too often of late years in the city of London cause to the insurance companies have had the effect of making these companies exceedingly shy of insuring large warehouses except at very high rates of premium, notwithstanding their being what is called fireproof. The reason is that, practically, such buildings do not turn out to be fireproof at all. If the insurance companies could be convinced that a building was really and not theoretically fireproof from top to bottom, we may be quite sure that for their own sakes they would not decline the insurance; and it is well worth the while of those who are erecting these gigantic piles of buildings which we see around us to consider whether the sum that would have to be expended to bring about this result would not be, in the long run, a most wise economy.

Iron and stone used to be considered fireproof materials, but sad experience has shown the fallacy of this opinion time after time. In America, the system of fireproofing has been carried much farther than with us, and it is there laid down as an axiom that no building can be considered fireproof unless the whole of the structural ironwork used in it be covered with a really fireproof substance. I wrote to one of the largest firms in the States, who make a special business of fireproofing, and asked for particulars of their practice — the Wight Fireproofing Company — and they were kind enough to send me an illustrated pamphlet from which some diagrams have been prepared. Some of the methods adopted do not differ widely from those in use in this country, such as Hornblower's system, but as the whole subject is one of great practical interest and importance, I will endeavor to explain the American systems somewhat in detail.

The first kind shows a combination of iron joists, concrete, and hollow fire-clay tiles of different depths. The hollow tiles are temporarily supported by centering, and are set in cement, the middle tile acting as a key-stone. The bottom edges of the tiles are grooved, in order to give a good key for the plaster of the ceiling, and on the top of the flat arch thus formed concrete may be laid of any thickness that seems desirable, thus entirely encasing the iron girder. The weight of the deeper arch is about thirty-five pounds per foot super. In erecting a new building there is, of course, no difficulty in providing a floor of this kind, but if one has to deal with ordinary wooden joisted floors in actual existence, it would be a very expensive matter to replace them with iron and concrete floors.

The next diagram shows a method of making wooden floors practically fireproof on the underside. This is done by flat interlocking fire-clay tiles carried by iron clips screwed to the joists, the underside of these tiles being grooved to form a key to the plaster. A space of two inches is thus left between the plaster and the wooden joists, and as the tiles themselves will stand almost any heat that can be brought to bear on them, the joists are absolutely protected; on the upper side, fine concrete or pugging might be used. This system of fire-clay ceilings can be affixed to existing floors by simply hacking off the laths and plaster. I believe this system to be absolutely new to this country, and it appears to me both simple and effective.

If iron columns are to be fireproofed, it is done by encasing them with fire-clay blocks, which are grooved and are secured by iron plates with claws, which fit on the rivet-heads. In circular cast-iron columns a metal band is brought round the column, hooked together, and dropped into the groove of the blocks. In either case a heavy bed of mortar is next applied, and then another course of blocks is bedded, or, as the Americans say, "crowded down" over the band or plate. This process is continued till the column is entirely encased, then it is plastered with Keene's or Parian cement, making a good surface for decoration.

No words of mine are needed to show how much more perfect such a system as this is, if thoroughly carried out, than what we are in the habit of using here. Soon after I had obtained these particulars from the Wight Company, Mr. Doulton, of Lambeth, kindly sent me a notice of his new patent, the Doulton-Peto fireproof blocks. These are extraordinarily like the first kind of American arch-blocks which I described, in fact, I believe the idea was obtained from the American system, and I have no doubt that Mr. Doulton will carry this system farther in the way of casing columns, etc. I do not think, however, he has as yet manufactured anything like the flat tiles for wooden joists.

I am not going to occupy your time further on this subject of fireproof floors, except to call your attention to an English system, whose merits I estimate very highly; I allude to Lindsay's steel decking, of which I have a model here. This consists of a series of steel troughs riveted together and supported either on walls or on girders, and filled in with concrete. The strength and rigidity of the small troughs are most surprising, and the small space which they occupy is even more astonishing, as for a space of thirty feet, the depth of the decking need only be five inches to support a load of one-and-one-half hundredweight per foot super. Another great advantage is that brick partitions can be placed on this decking and concrete in any position independent of walls or girders underneath. This flooring is largely used in the National Liberal Club.

With regard to this steel decking, it is a curious fact that many years ago a manufacturer, whose name I have forgotten, patented every form of corrugated iron which he thought could be manufactured, and left out the very one which has proved most useful. This form is based on the strictest scientific methods, as the top table is made thicker than the sides, and the sectional strength thereby greatly increased, and the various sections are riveted together at a point which is very close indeed to the neutral axis. The concrete used by Messrs. Lindsay is called by them pumice concrete, as it is very light and tough, and it is a good material for constructing roofs, domes, etc.

You will perhaps have noticed that I alluded to the wrought-iron columns of the Phœnix Company. Until the completion of the Inner Circle of the Metropolitan Railway, I do not think wrought-iron columns were much used in this country, but I believe their use will rapidly extend. We have been told for a length of time that when columns are beyond a certain length in proportion to their diameter, they fail by bending and not by crushing, and we also know that wrought-iron is much stronger to resist tension than cast-iron, and as it is an undoubted fact that connections can be made to wrought-iron much better than to cast, we have here a combination of advantages where long columns have to be used which cannot but be appreciated, and which our American cousins are not slow to avail themselves of. Messrs. Lindsay have been on this tack for some time, and they have sent me here a section of their wrought-iron column, the strength of which is patent to all.

The use of steel for constructional purposes is increasing rapidly, as it is so much more reliable than iron, and Messrs. Lindsay roll many sections of steel which can very easily be formed into columns by riveting. The safe loads which such columns will sustain are very great. For instance, a column made of a series of steel troughs, such as I have described, the total external dimensions being sixteen inches, would bear a safe load of one hundred and fifteen tons if thirty feet long, and the weight would be seventy-four pounds per foot only. I have roughly calculated the weight, and the safe load on a cast-iron column sixteen inches in diameter, thirty feet long, one and one-half inches in thickness of metal; I find the weight would be two hundred and twenty pounds per foot run, and the safe load one hundred tons. I do not think the day is far distant when steel will have almost superseded iron for structural purposes.

Anything of the nature of fireproof material seems to me worth attention, and I will therefore briefly notice a substitute for wood lathing, either for partitions or ceilings, of which I have a model in the room. This consists of galvanized-iron netting, which is fixed by staples to hoop-iron slips, which are themselves secured edgewise to the studs or joists. The wire netting is then covered with plaster in the ordinary way. The wooden framework of the partition may be replaced by a construction of angle-iron, which takes up only half the space of an ordinary quarter or brick-nog partition, and this saving of space may sometimes be of considerable importance. The only thing that I am doubtful about is its permeability to sound, but, after all, ordinary partitions, or even brick party-walls, are, as many of us know to our sorrow, far from impervious to sound. I should say that a small structure formed by this iron lathing was severely tested about a year ago in Manchester, and the chief of the Fire Brigade reported very strongly in its favor.

Next to preserving the interiors of buildings from fire, one of the most difficult tasks is to preserve the exterior from the ravages of time and the weather, and it is, in fact, almost impossible to find a natural stone that will withstand the damaging effects of such an atmosphere as we have in London. In many parts of the country, too, beautiful old stone edifices are going rapidly to decay. The work of restoration of stone buildings is always difficult and expensive, but a means of doing this with comparative cheapness has been invented by M. Tabary, whose metallic cement has been extensively used on the Continent. This consists of a trachytic stone reduced to powder and then reunited by an acid without being decomposed. The material thus formed is permanent, and harder than the stone itself; it is not moulded, but carved to match any pattern, exactly like stone, and the surface and color can be made so precisely to resemble the original stone that the joint cannot be perceived. Mr. Blomfield and Professor Lewis made a careful examination of several buildings in France where restorations had been made in this metallic cement, and they reported most enthusiastically of it, and since then Mr. Blomfield has used it in many of his restorations in England. I cannot help thinking that this invention ought to prove of enormous value, because it will enable us at a small cost to stop decay of the stone at the outset. With stone itself one always has to wait till a sufficient mass of the stone can be removed, because of the difficulty of adding small pieces to what is left, but this difficulty is now entirely overcome.

Many gentlemen that were present a few weeks ago at the reading of Mr. Crossland's paper on the Holloway College must have been

much interested by the short notice which he gave of a system by which the pressure on the water-mains of a building could be very largely increased at will in the event of a fire breaking out. The instances have been numerous in which, although the fire-hydrants have been in perfect working order, considerable damage has been done through there being insufficient pressure to put out a fire before it has got beyond control. In London, the pressure in the fire-mains at the ground level averages from twenty-five pounds to thirty pounds per square inch, which is reduced one-half at a height of thirty-five feet from the ground, *i. e.*, the pressure diminishes as it becomes more urgently needed, because it is on the upper floors and at the roof of a building that water-supply would be most effective. In order to remedy this it has often been thought necessary in the case of important buildings to erect a large tank at the top of a building, or even to build a water-tower at considerable expense, and even where a head of water of one hundred and forty-four feet can be obtained, the pressure per square inch in the mains is only sixty-three pounds.

Now the system which I have alluded to is the invention of Mr. Vinning, and is called the High-pressure Fire-hydrant System. It consists in connecting with the ordinary mains one or more closed steel tanks charged with water, which can be at any moment submitted to any desired pressure up to one hundred pounds or one hundred and twenty pounds per square inch. This pressure is maintained by a series of wrought-iron cylinders filled with compressed air by means of a small air-pump or by other means, and kept permanently at the required pressure. These cylinders can be placed in any convenient position at a distance from the water-tank, and are connected together by small pipes so as to form practically one vessel, the bottom of which is connected by a small air-pipe, about three-quarters of an inch internal diameter, with the water-tank. The means for throwing the apparatus into use is a strong valve, which, when shut, confines the compressed air to the cylinders, but by turning the handle the valve is opened. At the base of the water-container, there is a large float ball-valve, which closes the access to the mains as soon as the water is discharged, and thus prevents the air entering these mains.

The water-container can be made of any required size, but for a large building it would probably be preferable to increase the number rather than the size of the containers. It is calculated that a vessel containing 2,000 gallons would give, with ordinary-sized pipes, a delivery of fifty gallons per minute for forty minutes, and, as the extinguishing power of water is much increased by very high pressure, this amount would generally suffice for the suppression of a large fire. Of course, after once going off, the air-cylinders require re-charging, but an air-pump is not absolutely indispensable, as steel bottles containing air at a pressure of over 1,500 pounds are now prepared, which can be carried about to any extent. Mr. Vinning is now engaged in putting up this apparatus at the South Kensington Museum, by order of the Science and Art Department.

While on the subject of water-pipes, I should like to call your attention to a very beautiful invention which, again, comes from the other side of the Atlantic. Everybody is familiar with the corrosive action of water on metal pipes, and in some cases, very serious effects upon health have resulted from the combination of certain chemical constituents in the water with the material of which the pipes were composed. But I have here some glass-lined pipes, than which nothing could be more cleanly, and they can be made to any bend that may be desired. These pipes have been patented for some few years, but there was found considerable difficulty in making the joints sound; this has, however, now been overcome, as the joints are all ground by an emery wheel, and special washers are used, and I think there ought to be a great future before this invention. In addition to these pipes being non-corrosive, it has been found practically that it requires a much more severe frost to congeal the water in these pipes than in ordinary metal ones. This is due partly to the packing and partly to the bad conducting power of the glass. These pipes can be jointed with much greater ease and speed than lead pipes, and when this is taken into account, their cost will be hardly any more than lead pipes. For breweries, acid works, and other places where ordinary pipes are soon destroyed, these glass-lined pipes will be most useful.

As land increases in value in London and other large cities, the tendency is to increase the height of all business premises, and thus gain more room. We see this in the new warehouses which are constantly being erected, but we do not go anything like so far in this direction as they do in the States, where buildings of ten stories are not uncommon. These high buildings would be comparatively useless without a very complete system of lifts, and the one to which I shall call your attention seems to me to combine, in a high degree, mechanical skill, ease in working, and safety. You are, of course, aware that elevators may be divided into two main classes,—those in which the cage is suspended, and those in which it is fixed at the top of a ram, which is generally worked by hydraulic machinery. Ordinary suspending tackle answers very well for goods-lifts, but there is considerable risk in relying upon it for passenger-lifts, even when provided with safety-catches, and, in fact, in many Continental cities, suspended passenger-lifts are absolutely forbidden. With hydraulic-ram lifts, of the usual construction, it was necessary to excavate a chamber for the ram of the full height of the working of the lift, and in the case of hard soils, such as rock, this would entail very great expense. One method of overcoming the difficulty was devised by Messrs. Stevens, who formed their ram in a series of cylinders, working one inside the other; but I am not able to state whether this principle has been found to answer well. The Otis elevator is a suspended lift, worked by hydraulic power, but the arrangements are such that I believe it to be absolutely safe. The cage is carried by four iron-wire ropes, which pass to a wrought-iron yoke, and then, dividing into two pairs, are carried down to two timber beams, upon which the frame of the cage stands. The wire-ropes pass over a guide pulley, and also over a loose pulley, and are fastened to a strong beam at the top of the building. The ropes are not connected directly with the cross-beams, but with a balanced lever-beam, to the action of which I shall refer again.

The framework of the cage carries gun-metal guides, which slide on each side of the timber uprights. The motive power is water, but no excavation for a ram is required, as the cylinder and piston which constitute the driving power can be fixed on the ground bed. By the intervention of the loose pulley just mentioned, the ascent or descent of the piston in the cylinder for any distance lowers or raises the cage just twice as much, and there would of course be no difficulty in increasing the mechanical advantage by the use of more pulleys. [The action of the lift was explained by means of diagrams.] Now, everything depends upon the safety appliances of such an elevator as this. The causes of danger are three: First, breaking of the supporting ropes; second, too rapid a descent in consequence of heavy weights; third, the counterweight carrying up a lightly-loaded cage higher than is intended, and thus breaking the connection with the flanges. The latter was the cause of the accident at the Grand Hotel, Paris. As the cage is in itself slightly heavier than the counterweight, the latter accident cannot happen; and even if it could, and the piston-rod were broken, the only tendency would be for the cage to fall rapidly, and this cannot occur. In case of the breaking of any one rope, the balance-beam is acted on, and a wedge-grip is brought into action on both sides of the lift. If all the ropes were to break, and the cage were to commence to hurry to the bottom, a second safety device is provided which comes into play as soon as a certain speed is attained, and this brings the wedges into play at once and stops the descent of the cage. As soon as these wedges have acted, they cannot be released except by raising the cage. I believe, however, that no case is known of all the ropes breaking. It is important to notice that the mere stretching of one of the ropes affects the balance-beam, and thus advertises itself to the attendant, who must at once see what is the matter with the ropes, and properly adjust them. I believe that experience has proved that the wire ropes made by the American Elevator Co. last, on the average, five years.

Another important point to be noticed is that this lift can be worked at a very low pressure, say forty pounds to the square inch, whereas other hydraulic elevators require a very high pressure, that would have been almost impossible to obtain a few years ago before the introduction of the hydraulic power system of high-pressure mains, where pressure up to seven hundred pounds per square inch can be obtained. This is not the place to enter upon a discussion as to the relative merits of low and high pressure, but no notice of modern inventions would be complete that did not include this most valuable system,—in the starting of which our late President, Mr. Whichcord, took very great interest,—by which hydraulic power can be laid-on to any building in London from a central station.

To turn to a very different subject, viz., heating, I should like to say a few words about a new stove which has come under my notice, and which I have lately introduced into one of my buildings. This is the invention of Mr. Lofts, of Cambridge, and acts upon the principle of giving as large an amount as possible of radiant heat, by compelling the smoke and heated air to take a circuitous course, warming a large surface of metal before it goes up the chimney. It thus differs from the majority of improved stoves which have been manufactured of late years, and which for the most part rely upon warming a large amount of air and causing it to enter the room. Several tests of this stove have been made, and its economical consumption of coal has been clearly established.

It has probably been the lot of some of us to have to design buildings for clients in whose eyes economy is a virtue far exceeding artistic effect, and I believe it is not an unknown proceeding to be obliged to go through the drawings and specification with a builder in order to reduce the estimate. I have known cases in which an architect has been at considerable trouble to design a staircase, and to put a little of what is known as "feeling" into his balusters, etc. These are precisely the features which a builder will pitch upon with the remark, "There's a lot of work in that staircase, sir; I can get some very nice turned balusters that will look quite as well as this, and not cost half so much," and your staircase looks just like any other speculating builder's. Some very great improvements have been made in turning machinery lately, and balusters and newels can be got now "square-turned." I confess I do not know how it is done, as I believe the machines are kept in jealous seclusion, but I have some specimens of square-turned balusters which will give you an idea of what is, at any rate, a little variety from the ordinary run. These have been kindly lent me by Messrs. Carter & Aynsley, of Bishopsgate Street. I must not be understood as in any way approving the design of these, but the fact that it is possible to turn things square was quite unknown to me a few months ago, and I thought it might be of interest to this meeting to know that such a thing is possible.

In connection with house-fittings I would call attention to Kaye's locks, several specimens of which are on the table. The simplicity of construction of these locks seems to me very commendable, and they have given great satisfaction in cases where I have used them. I would particularly call attention to an automatic cupboard lock.

Among decorative appliances I may mention Radeke's compressed wood pulp, which has been used to some considerable extent abroad, although it has not found its way at all largely in England. Some kind of composition is used as a basis, and is laid on a thin veneer of any kind of wood, such as oak, walnut, etc., and the whole is then compressed by hydraulic power into moulds, which can be made of any required design, except that it is impossible to have deeply under-cut mouldings. The grain of the wood is excellently preserved, and the effect of the finished product as a means of wall decoration is certainly good. I believe it can be treated in all respects as wood, viz., cut, sawn, or planed.

Artificial illumination is a subject that has attracted great attention during the last few years, and the threatened rivalry of electricity has given a strong impetus to the improvement of gas-burners, in order to obtain more perfect combustion. Among these I may mention the Albo-Carbon light, the Wenham lamp, Sugg's Cromarty burner, the Siemens regenerative gas-burner, and the Welsbach incandescent lamp, which latter consists in the combination with the gas-flame of a thin cylinder of some refractory substance which glows at a white heat. Although electricity has not ousted gas from the field, as it was at one time thought it would do, it has yet made more progress than many people imagine, and no architect would now think of designing a theatre, music-hall, hotel, or restaurant without fitting it with incandescent electric lamps, which do not give off as much heat as gas, and, — more important still, — do not contaminate the atmosphere. The invention of storage-batteries as a sort of buffer between the machine and the lights, and as a means of avoiding the risk of break-down of the engine, did much to render electric lighting more generally available, and considerable improvements have been made in these storage-batteries during the last few years. In the earlier forms of storage-battery, — for instance, the Faure-Sellon-Volckmar type, which is most largely in use, — there is always a certain amount of local action going on between the lead plates; but in the battery of the Union Electrical-Power Light Co., which they have been kind enough to lend me to-night, there is no local action at all. The elements consist of solid slabs of peroxide of lead and plates of spongy lead, and are immersed in dilute sulphuric acid. The peculiarity of the peroxide plates is that the material used in its construction causes it to set into a perfectly hard and durable form, so that it is not injured by transport. The size of the plates is seven inches by four inches, and the total weight of the cell complete in a case is twenty pounds eleven ounces only. This lightness is achieved partly by the plates being loosely held by strips of celluloid, which material is also used to cover the strips of platinum by which contact is made. The elements are connected together by platinum wires dipping into small wells of mercury. Professor Forbes made some very careful tests of one cell of this battery, and obtained a discharge of about eight-and-a-half ampères for nearly fourteen hours. He also reported that the efficiency of the cell was between eighty and ninety per cent. The cells are contained in small wooden boxes, which are readily transported from place to place. When the elements are exhausted fresh ones can be supplied, and the old ones recharged, but spare plates can always be kept ready for use at any time. A battery of fifteen cells will run twelve ten-candle incandescent lamps, and occupies a few feet only. The recharging of the plates must of course be done by a dynamo machine.

While on this subject, I must mention a small primary battery and lamp combined, which will enable any one to have an electric lamp on his table at any time, and which can be recharged by simply pouring into the cell containing the plates the necessary liquid. These lamps are made in very ornamental cases, and one of the size here will run about three hours, *i. e.*, during the continuance of dinner; but if a larger size were adopted, they would, of course, last longer.

I now come to a subject which cannot be called in any sense an invention, but it is a discovery of very great importance as affecting the strength of materials, and although it affects engineers more than architects, I think we ought to be acquainted with its main features. For a considerable period it was considered sufficient to ascertain, with more or less exactness, the ultimate tensile or compressive strength of a timber beam or an iron bar, or any such material subjected to stresses or strains, and then to take a certain factor of this ultimate strength as a fairly safe working strength. But so long ago as 1870 a German engineer named Wöhler, made a very large number of experiments which showed conclusively that the breaking strength of any material depends not so much on the statical load, but on the *extreme variations* of load which the p ece has to undergo. For instance, taking 45,000 per square inch as the average breaking tensile strength of wrought-iron, a rod which would be subjected to a steady load of 90,000 pounds ought to have a sectional area of eight square inches, using a factor-of-safety of one-fourth; but if, instead of the steady load, the rod would be subject to alternate changes of load varying from 10,000 to 90,000 pounds, its sectional area would have to be eleven and one-fourth square inches. If the same rod were subjected to alternate compression and tension it would require to be even stronger. Wöhler expresses this law as follows: The fracture of a material can be effected by variations of stress repeated a great number of times, none of which reaches the breaking limit, the difference between the extreme stresses determining the breaking strength. Wöhler's experiments were purely empirical, and their results have considerably exercised the minds of scientific men, but another German, Professor Bauschinger, of the Munich Polytechnic School, has been carrying on for several years a most exhaustive series of experiments, the result of which are published in a series of memoirs to which Professor Unwin was kind enough to call my attention, and of which he has published a short *résumé*. The puzzling anomaly of Wöhler's experiments lay in the fact that when subjected to alternate tension and compression a bar broke down at a stress lower than its elastic limit, and Bauschinger thinks he has discovered the explanation to be that in many materials the elastic limit has been raised artificially in the process of manufacture. I have not time to pursue this question further, but one illustration will show how it may effect our work. In an iron roof of ordinary construction, in which the pressure on one of the struts under ordinary circumstances is 1,500 pounds, a heavy gale of wind would just double this, and this variation of pressure would reduce the ultimate strength of the strut nearly twenty per cent.

Professor Bauschinger has also carried out a large number of most careful and elaborate experiments on the behavior of full-size cast-iron columns and wrought-iron stanchions, under the influence of heat and sudden cooling, and he found that cast-iron did not warp so much as wrought, but that if cast-iron was heated to a certain point and then had a stream of water directed on it it bent so much that it broke in two. He has also experimented on piers of stone and concrete, and comes to the following general conclusions: First, that no natural stone will withstand fire, but that granite did so the best; second, that brickwork behaved much better than any stone; and third, Portland cement concrete was best of all. It is impossible to give any idea of the exhaustive and minute character of Professor Bauschinger's experiments, and he is, I believe, still continuing them, and their results must have a very important bearing upon our knowledge of the strength of materials.

The experiments from which the formulæ for the strength of timber beams, joists, etc., were deduced, were in almost all cases made on very small pieces, and it has been a pure assumption that larg pieces would behave in the same way. During the last few years a number of experiments have been made in the States, chiefly by Mr. Lanza at the Massachusetts Institute of Technology, on full-size pieces of timber; the results show that our ordinary formulæ require considerable revision. For instance, a spruce beam twelve inches by two inches by fifteen feet long, broke with a central load of 5,894 pounds. According to Tredgold's formula, it ought to have supported a load of 8,928 pounds before breaking. This result was corroborated by other tests, and the general conclusion arrived at is, that whereas we have been accustomed to use as a constant in the familiar formula $W = \frac{cb\,d^2}{l}$ four hundred-weights for fir or pine beams, — in fact, in one of Tredgold's examples 530 pounds is used, — we ought really to use a constant of not more than two-and-a-half hundred-weight. The more thoroughly large-size specimens, whether of wood or iron, are tested the more will our knowledge of their strength be increased, and we shall be less dependent upon theory.

In conclusion, I will only say that one most important discovery has been made in the last few years to which I have not yet alluded, and that is that one necessity for an architect is a thorough education, and the result of this discovery must have very far-reaching effects on our profession.

COMMUNICATIONS

TRINIDAD ASPHALT.

ALBANY, May 16, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,— Will Trinidad asphalt, placed on the exterior of stone-walls underground for a damp-proof course, decay?

Yours truly, F. H. J.

NOTES AND CLIPPINGS

AN AQUARIUM *au naturel* — Mention has been made in the newspapers from time to time of an aquarium that Mr. Adolph Sutro intended to build out upon the ocean-beach near the Cliff House. Those who have been out to the Cliff House and have descended the steps that lead to the beach will doubtless have noticed a little cove sheltered between two high rocks about 100 feet from the steps. In this cove the aquarium is now being built. The aquarium will consist of a round wall of rock 50 feet in diameter, 15 feet thick, and 14 feet high, and will be roofless. The flooring will be made in a unique way, according to Mr. Sutro's plans. Solid pathways of rock will be built around the interior of the aquarium, and between them there will be little ponds of water that will be 3 and 4 feet deep at low water. The water will come into these ponds from the ocean with fish and other marine objects in the following manner: A tunnel 300 feet long and 8 feet high will be bored through the rock between the ocean and the aquarium, and at the seaward side of the tunnel there will be wire-screen gates, which

can be opened and shut. At high tide the gates will be suffered to remain open, so that the water and the living objects in it can come freely into the aquarium. At high water the whole aquarium will be flooded — the pathways and everything — and no one can go in then. When the tide begins to recede the gates are shut, and only the water can flow through them. The living objects will be retarded, and will seek the comparatively deep water in the ponds, and thus they will be caught as in a trap. When the waters have receded sufficiently from the pathways the public will be admitted inside the walls. Sea-anemones, devil-fish, angel-fish, star-fish, crustaceans, shells, all varieties of large and small fish, and, perhaps, even occasional seals may be caught in this aquarium. At low tide there will always be something interesting to see there.— *San Francisco Call.*

Discoveries at Ancient Sidon. — Only a few weeks have elapsed since the world of archæology was highly interested by the news of a most-important archæological "find" in the neighborhood of the ancient Sidon. The discovery was made by Mr. Eddy, an American missionary, who resides at Saida. In a garden adjacent to the town he discovered a shaft which, on being explored was found to communicate with a rock-cut temple or tomb, containing several sarcophagi of Græco-Phœnician work. One of these with friezes, representing warlike combats and hunting scenes, was said by an archæologist who examined it to be one of the most magnificent specimens of art ever discovered. The Turks refused to allow photographs to be taken or to admit any Franks to the tomb, and, to the regret of science, news has just reached this country that this priceless work of art, together with several statues, have been broken to pieces, and that heads, arms, and other fragments are being offered for sale in the bazaars. — *Manchester Guardian.*

A Water-main struck by Lightning. — A correspondent of *Fire and Water*, writing from New Britain, Conn., sends the following account of the fracturing of a water-main by lightning: "During the heavy thunder-storm of February 18, the lightning, in addition to burning out a coil on the fire-alarm circuit, thus disabling the alarm for about an hour, also did considerable damage to the water-main on John Street. Closely following a very heavy flash of lightning, people in the act of drawing water from their faucets heard a cracking sound. One woman, who had her hand on the faucet, received quite an electric shock, and the water ceased running. On investigation, it was discovered that the 4-inch cement-lined water-main had burst in a number of places. Up to this time there have been found ten different breaks in the main, within a distance of 300 yards. All the breaks are on the top of the pipe, as if it had been struck with a heavy tool of some kind. Such a freak of lightning has never occurred in this city before. The bolt is supposed to have run down inside of the jacket of a fire-hydrant close to one of the breaks."

A Real Weeping Tree. — On my way to and from the Mussoorie Library I have noticed for some days a small pool of water in the middle of the road just above "Auchnagie." It struck me as being something singular; and to-day, when passing, I noticed several drops of water fall into it; on looking up I saw that it was the sap from a branch high up on a tree that was falling into it; the drops were large, and were falling at the rate of one a second. I afterwards noticed several other trees of the same kind on the roadside dropping sap from their branches in the same way. The tree is a large one, called by the natives Kagashi (*Cornus macrophylla?*). In the spring, if the bark of this tree is wounded by an axe, the sap runs out of the wound in a great stream; some of it solidifies into a thick mucilage of a bright orange color; it was from a broken branch that the sap was coming, broken, most likely, by the heavy fall of snow we had at the end of January. These trees are just bursting into leaf, but they have been weeping for the last ten days at least. — *A. C., in the Indian Forester.*

The "Jubilee" Service at Westminster Abbey. — It is to be regretted that the discussion upon the £17,000 to be expended on the Westminster Abbey jubilee service came on so late that the report had to be condensed in the daily papers, for a more profligate expenditure never has been permitted. The abbey is to be converted into a sort of Olympia, with great wooden galleries. The wood, which is only to be hired for a day, is to cost £9,000. It consists of battens, most of which will be as valuable after the ceremony as before. The galleries are to be covered with some sort of hangings, and cushions are to be provided. The loan of the hangings and cushions is to cost £5,500. Stationery is to cost £1,100, though what this stationery is to consist of no one knows. In addition to this the dean and chapter are to receive £500 for possible damage to the cathedral, and £300 as a *solatium* for not being able to hold ordinary services while the galleries are being erected. Mr. Plunkett estimates that galleries will seat 10,000 persons, therefore the seating will cost £1 4*s.* per head, whilst churches are entirely built at an average cost of £2 per head. But a most curious admission was made by Mr. Plunkett during debate. He said that Conservative supporters of the government had informed him that they would not vote for the expenditure unless their wives were given seats. These wives are, no doubt, very excellent and very charming persons, but they are expensive. We have it on the authority of Mr. Plunkett that had he not consented to their demand for seats their husbands would not have agreed to the estimate, so excessive do they deem it. — *H. Labouchere.*

Alexander the Great and Petroleum. — Many ancient authors mention petroleum, either in the form of crude oil for burning or as bitumen. The most interesting reference, however, to petroleum in the form of oil, is in Plutarch's "Life of Alexander the Great," where it is stated that in the district of Ecbatana (probably the modern Hamadan in Persia) "Alexander was particularly struck with a gulf of fire, which streamed continually as from an inexhaustible source. He admired also a flood of naptha not far from the gulf, which flowed in such abundance that it formed a lake. This naptha, in many respects, resembles bitumen, but it is much more inflammable. Before any fire touches it, it catches light from a flame at some distance, and often kindles all the intermediate air; the barbarians, to show the king its force and the subtlety of its nature, scattered some drops of it in the street which led to his lodgings; and, standing at one end, they applied their torches, for it was dark, to some of the nearest drops; the flame communicated itself swifter than thought, and the street was instantaneously all on fire." We also find recorded in Plutarch the very sad consequence of a practical joke played with petroleum for Alexander's amusement. "There was an Athenian who, among others, waited on Alexander when he bathed, and anointed him with oil; this man had the greatest success in his attempts to divert him. One day a stupid-looking boy, named Stephen, happening to attend at the bath, the Athenian said to the king, 'shall we make an experiment of the naptha upon Stephen? if it takes fire even upon him, and does not presently die out, we must indeed allow its force to be extraordinary!' The boy consented to undergo the trial; but as soon as he was anointed his whole body broke out into a flame, and Alexander was extremely concerned at his danger. Nothing could have prevented his being entirely consumed by it if there had not been people at hand with many vessels of water for the service of the bath. As it was, they found it difficult to extinguish the fire, and the poor boy felt the bad effects of it as long as he lived." We must, in this case, suppose that a light was applied to the boy, after being anointed with oil, or else that he was in the immediate vicinity of a large fire used for heating the bath. — *Murray's Magazine.*

TRADE SURVEYS

Nothing has occurred during the week in commercial or financial circles to weaken confidence or depress prices. The mass of railway and financial statistics furnished each week exhibit growing strength and activity. The industrial conditions are favorable. Work is abundant. Wages are advancing in some crafts because of the active demand for special skill. The output of furnaces, mills, and factories has been subject to scarcely any control. The go-as-you-please race for trade is stimulating enterprise. Financiers are offered their pick and choice of opportunities. Industrial managers do not discern the outlines of trade-disaster on the horizon. Demand is surprising the conservative. Production is galloping at feverish pace, but accumulation has not set in. Trades people are cautious and purchase only for visible demands. Shop and factory owners are pretending to gauge production to market demands, but could increase their output very little at best. Bankers are rather seeking borrowers throughout the interior. Merchants and jobbers are distributing merchandise to their satisfaction. Labor agitations are confined within narrow limits. Employers are now flocking together in spirit and fact as never before. The always-present germs of disruption are directing the attention of labor leaders to internal differences and elements of disruption rather than to outer objects. The volume of business for the week is larger than for the week previous. The expected anticipation of summer requirements has not yet set in in the heavier industries. In textiles, hosiery, and knit-goods manufacturers have placed the bulk of their output for the fall; in woollens and worsteds restriction is observable; in cottons activity has not been arrested. In hardware New England manufacturers have enjoyed a busy season, and the probable consumption has been carefully calculated. Barbed wire is declining. Implements for farm work are offered at a moderate discount. The demand for motive power for shop, river, lake, and coastwise crafts has greatly improved, and this branch of industrial activity will, for the next twelve months, absorb increased material and labor. Water-ways will be more largely used in the future both North and South, especially as the smaller industries multiply in the Ohio and Mississippi valleys. Though the volume of traffic can never reach the enormous railroad volume, yet the tendency now is towards a multiplication of water traffic, and this will greatly increase the demand for all subordinate appliances. The architects in all large cities continue to report a rush of work. Their services are more widely sought for ordinary work which, in recent years, was done by builders by rule-of-thumb. The architects have forced a recognition of their services and are putting strong foundations under their profession. There is a marked increase in the number of office-buildings and of banks. Railroad companies are about expending large sums of money to complete terminal facilities and office conveniences. Church work is quite abundant, and architects are giving church architecture closer study, and are escaping from some of the old ruts. Suburban building activity is general in all large cities, and there is a remarkable activity in lot selling and in alteration of old houses and stores for modern uses. In fact, many of the older Eastern cities show that a rapid transformation is in progress. City residents are surrendering homesteads, and suburban places are receiving new accessions. During the coming six months, it is said, on good authority, that a dozen or more cities will be furnished with electric street-car lines. The hesitancy shown to the adoption of one of the many systems is due to the fear of investors that something better or cheaper will be found. The iron and steel makers are crowding every furnace and roll, but feel anxious to book summer business which conservative buyers are holding back. There is an overproduction of nails which can hardly be prevented. Merchant-iron is next weakest on the list; plates and sheets third. Crude iron is strong under the extraordinary output of 20,000 tons per day. Bridge iron comes next to steel rails in strength and activity. The lumber manufacturers and dealers indulge in their chronic complaint about business, but their only trouble is to get lumber fast enough to fill orders. The receipts of white and yellow pine and of hardwoods while heavy are no greater than needed. Hemlock is very active in Pennsylvania, poplar in West Virginia, and walnut in Tennessee. New sources of supply are coming within reach of water and rail. The coal trade is once more improving in trade parlance, but it has never been weak. In anthracite the production is one million tons ahead of the production at this date last year, and a restriction is now on which will reduce the supplies three quarters of a million tons. Buyers have begun to run-in their orders. The locomotive-builders anticipate quite an increase in orders. With all the activity in railroad-supply establishments the minimum of motive-power and rolling-stock is at work. Whatever of conservatism is shown by consumers is due to the possibility of a reaction in a year or two which will create a tumble in values of material and labor. Buyers of products which are to last many years will hesitate to fill their maximum requirements on a rising market. But neither markets nor trade are controlled by the pretended foresight of individuals, or any number of them. The country seems to be blindly stumbling headlong into prosperity, and unexpected markets are opening up on all sides.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, by TICKNOR & COMPANY, Boston, Mass. No. 597.

JUNE 4, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

THE Archæological Institute of America begins its tenth year with encouraging prospects, although nothing of extraordinary interest has been accomplished during the past twelve months. An attempt was made by its indefatigable explorer, Mr. Joseph T. Clarke, to investigate some interesting ruins in Magna Græcia, but the owner of the land objected, and the Italian Government put a summary stop to the operations. Enough has, however, been ascertained in various parts of Southern Italy to show that an immense amount of valuable archæological material lies hidden there, waiting for the work of the explorer. The American School at Athens, which the Institute probably regards as the nucleus of its activity, has been provided with a house of its own, and now needs an endowment for the support of a permanent director, in place of the volunteers who have been sent out from year to year by various colleges. Some progress has already been made toward the provision of such an endowment, and it is hoped that a fund of one hundred thousand dollars will be raised in time to secure the services of Dr. Waldstein, the most noted of all American archæologists, who has promised to accept the directorship if the endowment is soon made complete.

ONE of the most terrible theatre fires ever recorded took place a few days ago in Paris, where the Opéra Comique, perhaps the most popular theatre in the world among intelligent people, took fire, and was destroyed, together with about two hundred of the audience. It is the boast of the French that their theatres are very substantially built, but, to make up for this, the ways to get out of them are often long and narrow, and if a panic breaks out, a disaster is sure to follow. In this case the building, which served as the home of the Italian Opera until the present opera-house was constructed, was, like the new one, made almost entirely of iron and stone. This, however, did not save either it or its occupants from the effect of a conflagration which broke out on the stage. The fireproof curtain, which is now regarded as an indispensable part of modern theatre fittings, seems here to have been wanting, or not in condition for use, and, indeed, a false feeling of security seems to have prevailed all over the theatre. According to an American among the audience, who escaped with his life, the light of a fire among the stage machinery had been visible from the seats near the proscenium for some time before it attracted the attention of the rest of the spectators. When a movement in the house showed that the increasing flames had been observed, one of the singers, in a well-meant effort to prevent panic, announced from the stage that the fire was trifling, and begged the spectators to remain quiet. They obeyed, unfortunately for themselves, and in a moment a rush of fire through the proscenium arch filled the auditorium with smoke, and sent the audience, frenzied with terror, in mad confusion toward the doors. As usually happens in such cases, a large part, perhaps all, the persons in the gallery were suffocated before they could get out, and of the others scores were trampled upon or burned; while on the stage, which was nearer the fire, the destruction of life was even more rapid and complete. The lesson of the catastrophe seems to be the old one, that no theatre, however incombustible, can preserve its occupants from death if the smoke and flames from burning scenery on the stage is allowed to get into the auditorium; and it should be noticed also that the slight delay caused by the reassuring words of the actor proved fatal to many persons. The temptation to cool-headed persons to check a panic by underrating the danger is very strong, and those who value their lives should remember this. Until theatres are built in a manner very different from that now in use, the wisest course for a spectator is, as soon as an incipient blaze is seen or reported on the stage, to run instantly for the nearest door. It should not be forgotten that the longest interval known to have elapsed between the entrance of flames from the stage into the auditorium, and the complete extinction of life among the persons remaining in the room, is seven minutes, while the average interval is only about five minutes. Now five minutes is a short time to get out of a theatre in a crowd, even for persons not choked and bewildered with smoke and terror, and only those can hope to succeed who start early and move quickly.

EVERY one who takes an interest in the architecture of the Middle Ages will hear with sincere regret of the death of M. Ruprich-Robert, which occurred at Cannes a few weeks ago. M. Ruprich-Robert, as we learn from the *Courrier de l'Art*, was born in Paris in 1820. He showed, when quite young, a strong inclination toward the study of architecture, and was placed with M. Constant-Dupaix, under whom he pursued the course at the Ecole des Beaux-Arts. Even at that day he exhibited an interest in the forms of mediæval architecture, which, though not calculated to win for him the suffrages of the juries of the *Concours*, brought him, later, an appointment on the Commission of Historic Monuments. For this Commission, to which he was attached during the remainder of his life, he made many drawings and restorations, and designed a good deal of new work in his favorite style, of which he was recognized as, perhaps, the most consummate master after Viollet-le-Duc. Being naturally of an active and enthusiastic disposition, he had frequent occasion to defend his ideas, or criticise those of others, and showed always a clearness of thought and expression which made his articles interesting reading, even for those who did not agree with their author's opinions. These occasional papers were followed by more permanent books, of which the beautiful work on Norman architecture, which is not yet quite finished, is the latest and best known. Although fond enough of controversy to be almost constantly engaged in some dignified dispute on archæology or architecture, he was sincerely devoted to his profession, participating in all movements and discussions which he thought likely to benefit it, and often contributing greatly to the efficient conduct of them. In him the mediæval party in French architecture loses the last of its great leaders. There are still plenty of mediævalists left, but they seem to lack the aggressive enthusiasm of Ruprich-Robert and Viollet-le-Duc, and their influence upon public taste is likely for some time to be quite insignificant.

WE are glad to see that one of those airy editors, who delight in ascribing all sorts of imaginary blunders to architects, has come to grief, and, through the persuasion, it would appear, of the counsel for an architect whom he had used to make a joke about, has been induced to make a very humble apology, the recollection of which will probably prevent him from meddling with the profession for some time to come. The architect who had the courage to bring to justice the author of certain entertaining reflections on him was Mr. W. H. Crossland, the architect of the splendid Holloway College buildings, near London. The buildings are all finished, and ready to be opened as soon as the officers are chosen and the necessary apparatus of instruction provided. As the managers of the college did not see fit to take the public into their confidence while these points were being arranged, there was some wonder expressed at the delay, and the editor of the *Journal of Education* volunteered to explain it by saying that "it was reported that the delay in opening the Holloway College had been occasioned, not only by the difficulty of choosing a principal, but also by a more substantial impediment, the absence of drains, a detail that architects have a way of overlooking." The idea of an architect's forgetting the drains of a costly building would appear to any one in the profession too absurd to be seriously

entertained; but the public readily swallows assertions of this sort, and most of the readers of the *Journal of Education* probably thought, with smiles, how much better they could have done the work than those poor fools in general who practise architecture, and the architect of the Holloway College in particular. Mr. Crossland, hearing of this, seems to have placed the matter at once in the hands of his lawyer, who, a few days later, sent to the architectural journals for publication a letter from the editor of the *Journal of Education*, saying, in regard to the statement about the absent drains, that, on inquiry, he had satisfied himself that the report was wholly without foundation, and that, on the contrary, the drains were complete, and had been highly approved by Sir Robert Rawlinson. The letter went on to express much regret that the statement had been made, and concluded with a formal assent to the publication of the apology. As the statement of the *Journal of Education* was quite as much a reflection on other architects as on Mr. Crossland, we think that the whole profession is entitled to participate in the apology, and are glad to give it as wide publicity as possible.

THE accounts of the earthquake in Mexico ought to make still more evident than before the part which skilful architects may take in making buildings in earthquake countries secure; and if no other good comes from such occurrences, every shake at least calls the attention of intelligent people to the essential difference between a well-built and a badly-built house. The Mexican buildings are, as a rule, constructed of soft stone, not too well put together, and are, in consequence, easily cracked and dislocated by movements which would not injuriously affect a piece of well-executed masonry, so that the lightness of the shocks alone appears to have saved the city from a serious disaster. The frightful earthquakes of last year on the Riviera gave still stronger proof of the certainty with which movements of the ground search out the weakness of walls. In that country the ordinary building material is an incoherent rubble of small stones, stuck together with the lime-mortar which the Italians make so well, and plastered on the outside with a coat of the same, which, when washed with pink or yellow, with white window dressings moulded in relief in the same material, has a substantial appearance which is quite deceptive, and walls of this material are often carried to a great height and length, as in the immense hotels which line the beach at Nice. When finished, all these rubble structures look alike, and whatever bond may exist in the hidden masonry is likely to be due to the care of the architect in drawing up his specifications, and his vigilance in seeing them carried into execution. The Italian mortar is so admirable that walls with no bond at all will resist for centuries the ordinary disintegrating influences; and any one but a conscientious and faithful architect is very likely to forget or neglect the selection and interlocking of the stones themselves by which alone the wall is given permanent tenacity; but the slightest trembling of the earth tears apart the mortar of a wall not properly bonded, and a stronger shock throws the whole down in a heap. In the smaller towns, such as Porto Maurizio and Diano Marina, where the buildings were all of the cheapest and poorest construction, hardly anything resisted the earthquake, and there the loss of life was terrible; but in Nice, which pretends to possess a highly-developed architecture, the losses were confined almost exclusively to the buildings which were inwardly of bad workmanship, although these included some of the most ambitious and showy structures in the city, among others, we believe, the new concert-hall built by the municipality, and one or two of the finest hotels. The houses built with care, under expert direction, escaped serious injury, we believe, without a single exception; and so obvious was the reason of their immunity to those who compared them with the buildings destroyed that in one instance the owner of a new house which had passed through the earthquake without injury, while those of his neighbors were falling upon their inmates, hastened in search of his architect, as soon as the confusion had subsided, to thank him in the warmest manner for the skill and faithfulness to which he and his family had perhaps owed their lives. It is not often that an architect receives such a recognition of his care, and perhaps nothing less than an earthquake would have called it forth. Under ordinary circumstances the proprietor of a house built as it should be, among a score of others built as they should not be, would have been far more likely to upbraid his architect for having made his house cost a few francs more than those of his neighbors through his ridiculous fussiness, and to injure his business by dissiminating complaints of his extravagance, than to thank him for his conscientiousness; and the poor professional man would have to solace himself as well as he could with the knowledge that he had done his duty; but it should be remembered that the object of faithful work is to prepare for the time of trial, not for that of prosperity, and the sneers and misrepresentations of years would be far more than compensated by the consciousness that one's skill had saved his employers from pain or loss.

AN immense amount of work is being done just now in changing the face of nature so as to open new routes for communication, either by sea or land, or to reclaim districts unfitted at present, through natural causes, for habitation. In Russia a vast work of drainage has been accomplished, by which a tract of marsh and lake in the southwestern part of the empire has been converted into an extremely fertile district of great extent. In Italy the Prince Torlonia has completed his undertaking, of draining the fertile tract which has for ages been covered by the waters of Lake Fucinus, in the highlands which border the Campagna. This work was accomplished by boring a tunnel through one of the enclosing mountains, and it was discovered, as the excavation went on, that the Romans had endeavored to do the same thing in the same way nearly two thousand years before. In Africa, the scheme to which the late Captain Roudaire gave his life is likely to be carried out, after a fashion which he never contemplated, and which seems likely, hereafter, to give some trouble to those scientific persons who helped to disappoint him by their predictions of the impracticability of his plan. It will be remembered that he wished to interest the French Government in the excavation of a canal from the Mediterranean to the low lands in Tunis, lying at some distance from the sea, but at a lower level. His idea was that the flooding of this tract would not only render fertile a large territory in Africa, but would also, in some degree, moderate the dryness of the South winds on the coast. All sorts of objections were raised to his scheme by scientific men, some of whom asserted that his canal could not supply water fast enough to make up the loss by evaporation, and that the lake would soon become a mass of salt. The French Government appointed a commission to examine the ground and see whether Captain Roudaire's theories were well founded; but this commission, after taking careful levels through the country, reported that the area which would be overflowed by the canal was much smaller than the captain thought, and it was decided to be unwise to go to the expense of constructing the canal for so small a gain. In the course of the explorations an artesian well was sunk in one of the low-lying districts, and at the depth of about three hundred feet water was struck, which rose fifteen feet above the mouth of the shaft. For the first year the flow averaged only seventeen or eighteen hundred gallons a minute, but it increased very rapidly, and is now about twenty thousand gallons a minute, the waste forming a river of tolerable size, along the banks of which vegetation is springing up, while families of Arabs are coming from all quarters to make for themselves permanent habitations in the neighborhood. So far, the water has shown no disposition to dry up and leave nothing but salt behind it, and new wells are to be sunk at once, and a regular system of irrigation introduced throughout the region.

THE Fahlberg "saccharine" seems destined to play before long a considerable part in the commerce of the world. Patents have been taken out in various parts of the world, and the manufacture of artificial sugar has been already begun. In the opinion of the inventor, the artificial compound will not at present compete with the cane sugar of the West Indies, but he thinks that the persons interested in the production of beet sugar, which is the universal sweetener of continental Europe, would do well to plough up their beet fields at once, and sow them with wheat, and take steps toward the conversion of their vacuum-pans and filters into apparatus for the treatment of glucose and saccharine, or, as the scientific men prefer to call it, anhydro-ortho-sulfo-benzoic acid. It seems to be proved that the substance, notwithstanding its name, is in no way poisonous or injurious, and even if the sale of the counterfeit sugar produced by its use should be prohibited, as the beet-root people would like, it is hard to see why it cannot be used with perfect propriety in preparing syrups, preserves, jellies, and many other things which now consume vast quantities of sugar. In fact, many tons of glucose are already used for this purpose, and the addition of some fresh sweetening to the glucose could hardly make it objectionable.

EARLY SETTLER MEMORIALS.[1] — X.

DETROIT, MICH., AND THE JESUITS.



Statue of Antoine de la Mothe Cadillac, City Hall, Detroit, Mich. J. Melchers, Sculptor.

THE early history of the Catholic priests and Jesuits in America reads like a fearful fairy tale. It needs no assistance of the imagination to picture them to the mind of the reader as veritable spirits sent from heaven for the purpose of human sacrifice. Their loyalty to their religion, and the sufferings they endured at the hands of the American Indians are almost incredible. All other enterprises in the cause of religion, civilization, or discovery, seem tame and colorless when compared to those undertaken and carried through by the forerunners of the Catholic faith in the limitless wilderness of Canada and the great West. The writer regrets that it is not in the purpose of these articles to give even a short account of the wonderful performances of these religious pioneers.

Save the rude pictures and statues found in Catholic churches and convents, no memorials of importance have been erected to their inspiring memories.

In 1884, Hon. Bela Hubbard, a wealthy and public-spirited citizen of Detroit, caused to be placed in niches on the outside of the City Hall, the statues, cut in Ohio sandstone, of the priests Marquette, La Salle and Richard, and of Cadillac, the founder of that city. We have been unable to get any information concerning their cost, and only succeeded in finding a small photograph of the plaster model from which the Marquette was executed, and a miserable wood-cut of the figure of Cadillac. The history of these statues is like that of many others that are scattered here and there over the country. Some one is willing to give money to pay for them, anybody who can murder clay and stone makes them, they are put in their places, and that is the end of them so far as art or any earthly interest is concerned. The mere fancy to spend a little money on a wretched statue is deserving of very little commendation. In one respect, at least, Detroit is less pretentious than Plymouth, for Marquette and his fellow images are out of the sight of passers-by, whereas the Plymouth caricatures cannot be escaped. The statue of Cadillac was made by Mr. Julius Melchers, and Marquette, La Salle and Richard by Mr. John M. Donaldson,



Statue of Pere Marquette, City Hall, Detroit, Mich. J. M. Donaldson, Sculptor.

JAMESTOWN, VIRGINIA.

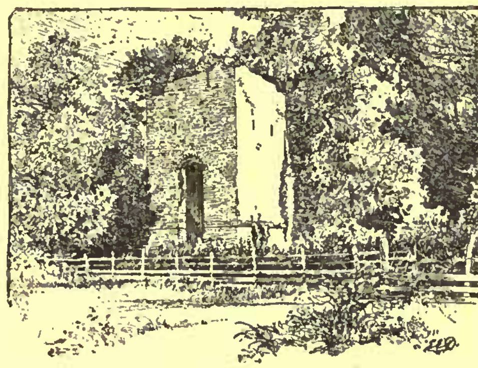
The first permanent English colony in North America was made at Jamestown, Va., May 13, 1607. The leader among the settlers, who numbered one hundred and five men, without women or children, was Captain John Smith.

The party was made up of "useless gentlemen," a few mechanics or farmers and some pardoned criminals, all adventurers, looking for gold. They were reckless and wasteful, building a church that cost fifty pounds and a tavern that cost five hundred. When the wives and children of these men came out to them, and when they began to have comfortable homes they did better. Smith went to England in 1609, and never returned. After his departure things grew worse and worse among the emigrants; and in six months they left Jamestown in despair, meaning to return to England, but on the way down the James River they met the long-boat of a vessel which was bringing them supplies and a new governor, Lord de la Ware, or Delaware. They then returned to Jamestown.

The settlers in Virginia did not generally live in villages, like those of the more Northern colonies. The soil was so productive, and the cultivation of tobacco so profitable that the men paid little attention to commerce or the fisheries; and they were not, like the Eastern colonists, obliged to live near one another for protection against the Indians. So no large towns were established; but they cultivated separate plantations, and it became the practice to send out "apprenticed servants" from England, who were sold for a certain number of years to the planters. These servants were men who had committed crimes, or rebelled against the government, and who were sent to America in order that they might be of some use. In 1620 a Dutch trading-vessel brought a cargo of twenty negroes from Africa, and the planters eagerly bought them, thus laying the foundation for the institution of slavery. In the early days of the colony ninety respectable young women were sent out from England; and whoever took one of them for a wife was obliged to pay a hundred pounds of tobacco. In 1671 a Virginia governor said, "I thank God there are no free schools nor printing; and I hope we shall not have them these hundred years." Another governor gave orders "to allow no person to use a printing-press on any occasion whatever"; and still another taxed school-masters twenty shillings a head. Yet William and Mary College, in Virginia, is, next to Harvard, the oldest college in America, having been founded in 1692. It had twenty thousand acres of land from the English king and queen, for whom it was named.

Nothing could exceed, in tyranny, the laws by which the first Virginia settlers were governed by the king of England and his council. The early history of the settlers has many pages of a most disreputable nature. Many of the clergy were given to drunkenness, gambling and other vices. After a time the people of Virginia secured the right to govern themselves. At the time of the American Revolution Virginia was the leader among the colonies, the first to propose separation from the mother country, and furnished many of the ablest men, both in Congress and in camp.

Nothing remains of the famous settlement of Jamestown but the ruins of a church-tower about twenty feet high, some old tombstones, and the almost indistinguishable masonry of a magazine. The tower is crumbling year by year, the roots of the trees have intermingled with the bones of the dead, and the stones, upon which could once be read the names of the "Armigers" and "Honarables," are broken in pieces, impenetrably hidden by brush and briars, and become lost to the sight of man.

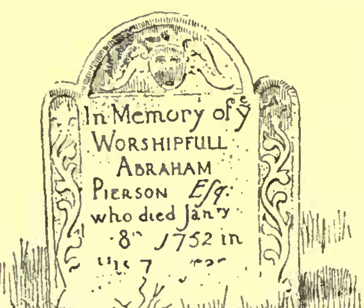


Ruins of Church-tower on Jamestown Island, Va.; believed to heve baen built in 1709.

The place once occupied by the huts of the first settlers is already covered by the sea, and naught is heard in this desolate locality but the noise of its ever-encroaching waves, and the fitful cry of the sea-fowl as it flits hastily by.

War, fire, and public indifference have brought desolation to William and Mary College. Neither light-hearted student, nor learned and self-sacrificing professor treads its grass-grown campus or breaks the silence of its halls. As each September comes drearily around, the old gray-haired president goes to the bat-inhabited belfry and rings out a peal that wakes no echo save in the histories of those who once animated its walls.

ABRAHAM PIERSON.



Yale College was founded in 1700 by ten ministers belonging to the colony of Connecticut, who came together in the town of Branford, bringing with them a number of books, which they placed together upon a table as each minister pronounced these words: "I give these books for the founding of a college in this colony." The Rev. Abraham Pierson, of Clinton, was chosen as the rector of the divinity school, or the first president of the college. The old, red sandstone tablet, erected to his memory in the cemetery in Clinton bears the following inscription:

"In Memory of WORSHIPFUL ABRAHAM PIERSON, Esq^r
Who died Jan^ry 8^th 1752 in His 79 year."

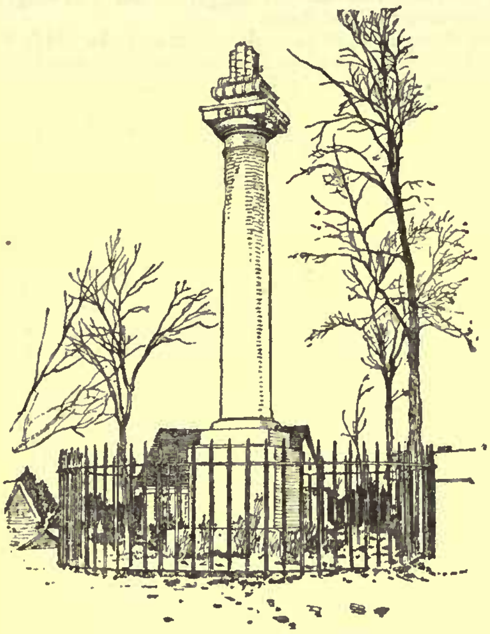
Very many years ago the professors of Yale College erected on Meeting-house Hill, in Clinton, the base stones of the column monument, and on the top of the stone which now serves as the plinth of the column, they intended to place an hour-glass. But this appropriate completion never having been made, Gen. William A. Pierson, of Windsor, Conn., the only living male descendant of the first president, erected, some years ago, the column, cap, and books as they now appear. One side of the die bears a latin inscription, on another side are the words: "The earliest senior classes of Yale College were taught near this spot by Abraham Pierson, 1701–1707." The cap of the column is inscribed with the words uttered at the time of giving the books. The weed-covered and almost indistinguishable spot of earth that encloses the remains of the reverend rector appears to have been quite forgotten by those who made the monumental pile or set up the brazen images.

In 1872 Charles Morgan, Esq., of New York, a native of Clinton,

[1] Continued from page 222, number 593.

and the founder of the Morgan School in that town, commissioned Mr. Northrop, the secretary of the Board of Education of the State of Connecticut, to procure duplicate bronze statues of Pierson, one to be placed on the grounds of Yale College, and the other in the yard of the Morgan School.

Several sculptors were asked to make sketches for the statue, and after the usual amount of competitory contention that generally characterizes matters of this kind, the commission was finally given to Mr. Launt Thompson, of New York, by the decision of the authorities of the college. Owing to certain unsatisfactory circumstances occurring previous to the decision there was some doubt entertained by various persons in regard to its justice. Accordingly, one of the professors of the college who had favored the decision, and taken part in it, was asked for an explanation, and why Mr. Thompson was selected in preference to any one else. The explanation was also asked because it was thought that a committee of scholars would show a finer and more comprehensive judgment in a matter of this kind than the ordinary committeeman. "What could we do?" said the professor. "None of us knew anything about art, and we did not wish to take any responsibility in the matter. I have no reason to believe that Mr. Thompson can make a better statue than A or B, but he has a popular reputation, and we depend upon that. If he fails the blame will be on his shoulders, not on ours." "But was it not right to expect that you would act from a higher and more critical point of view than that which governs the average citizen. That, certainly, was expected." "Well, the fact is, we did not feel like making experiments, and we had to trust to what is popularly thought of Mr. Thompson, not on an examination of what he has done or can do." Another professor, when asked the same question, made much shorter work of it. "Mr. Thompson had the inside track and the strongest personal backing." After the statue was erected the first professor was asked what he thought of it. "It is good enough. It is draped in the costume of the period. The public won't know the difference between this and a better one." "But is this the position that an institution of learning should take in the matter of public statues? Is the representation of costume in bronze all there is to a statue?" "Well, it seems to be about all that the sculptor has got out of Pierson."



The Pierson Monument, Clinton, Conn.

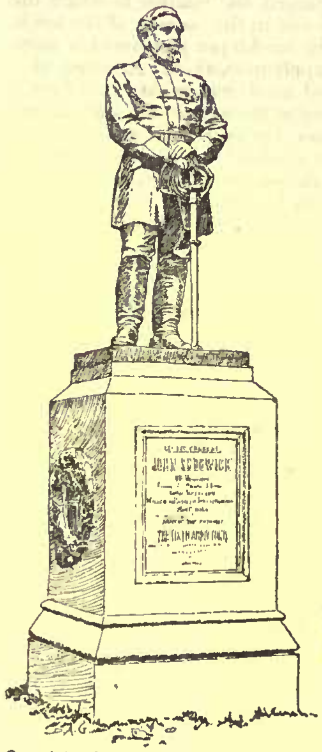
The copy intended for Yale College was unveiled in June, 1874, in the presence of the college corporation, many alumni, the State government, and a large number of citizens.

In all that was said during the dedicatory ceremonies no allusion of any significance was made to the statue as a work of art, or of Pierson as an ideal subject for sculpture. The times in which he lived were commented upon by Governor Ingersoll; Ex-President Woolsey spoke of the meagre history of the founders of the college, and the Rev. Dr. Leonard Bacon gave a biographical sketch of the first president. The only thing about the statue which the reverend gentleman cared to notice was, that the book which Pierson held in his right hand was copied from an old Indian volume entitled "*Cartwright's Commentary on the Book of Proverbs.*" The only recognition of the statue by those present began and ended during the moment the event of unveiling took place.

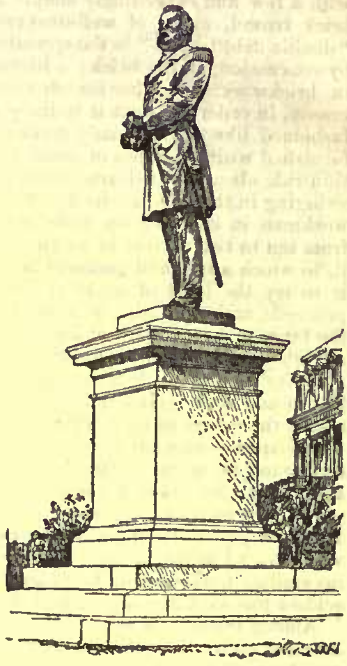


Abraham Pierson, New Haven, Conn.
Launt Thompson, Sculptor.

Mr. Morgan had also a statue of himself, made by Mr. Thompson, and erected with its companion, the duplicate Pierson, in front of the school-house in Clinton. We should make no critical allusion to the Pierson or Morgan statues, for the reason that they would not be called sculpture by any proper interpretation of that word, were it not for the fact that they are the work of a sculptor who was selected by the authorities of one of the largest and most influential institutions of learning on this continent, and which has had connected with it for more than twenty years an extensive museum and school of fine arts. The Pierson represents what the college was able to get in the matter of sculpture.



Gen. John Sedgwick, West Point, N. Y.
Launt Thompson, Sculptor.



Admiral Dupont, Washington, D. C.
Launt Thompson, Sculptor.

In the *American Architect* of October 2, 1886, we referred to the continual habit of influential newspapers and magazines of berating the "vulgar pretenders in art," the "art contractors," and "the builders of ungainly statues and monuments," and of laying the entire blame for the multiplicity of these objects at the doors of this class of unnamed persons. We venture to suggest that it would be found, upon examination, that these wretched statues and monuments were the result of a public approval, expressed by eminent representatives of what are known as art-lovers, amateurs and artists, as well as the innocent dwellers in the rural districts. The big pile of granite in Plymouth, known as the National Monument to the Forefathers, is an illustration of the correctness of this suggestion. Its existence is due to the support given to it by the representative citizens of New England. The Pierson and Morgan statues are also illustrations. The conversation with the professors of the college, above quoted, shows that the authorities of Yale were quite as incapable of solving the difficult preliminary question of how to get a work of art in sculpture as the ordinary committeeman.

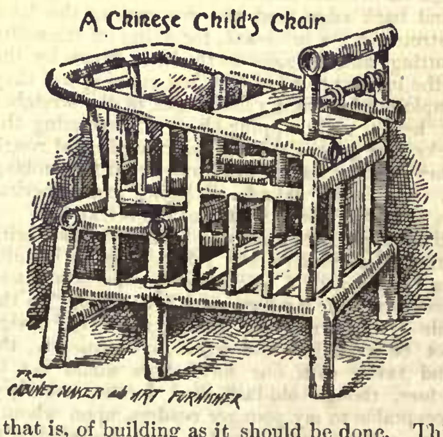
The Pierson and Morgan, like all of Mr. Thompson's statues, of which we give several illustrations, are lacking in many of the qualities of sculpture.

T. H. Bartlett.

[To be continued.]

HINTS FOR BUILDERS.[1]—II.

BRICKLAYING.



PASSING on from drainage, I come now to a brief consideration of the intimately associated work of bricklaying. Many persons who set themselves up in the present day as builders — and even occasionally as architects — are nothing more nor less than bricklayers, who, though capable of laying a course of brickwork in a proper and workmanlike manner, are yet totally incapable of building — that is, of building as it should be done. This is, however, a matter which will be remedied by education as time goes on.

[1] Continued from page 168, No. 588.

Bricklaying, known alike to the ancient Egyptians and Romans, is the art of building with bricks or of uniting them by the aid of cement or mortar into various shapes or forms, for the serving of a multitude of purposes. Bricks are generally made in one size and form — an oblong about eight inches in length, four inches in breadth, and two inches in depth. Their quality varies greatly, this depending upon the quality of the material employed, the manner in which the clay is tempered, and the method pursued in the burning of the brick.

It may here be mentioned that the bricklayer executes his work with a few and exceedingly simple appliances, these consisting of a brick trowel, made of well-tempered steel, and which contrives a "double debt to pay" in the spreading of the mortar and the cutting, by concussion, of the brick; a hammer, for cutting holes and chases in brickwork, and also for driving or dividing bricks, for which reason, in order to adapt it to these various requirements, one end is fashioned like the ordinary household hammer, while the other is furnished with a species of small axe; a plumb-rule, consisting of a thin rule about half-a-dozen inches in width, with a line and plummet swinging in the middle, the use of this implement being to guide the workman in carrying up walls perpendicularly; the level, ranging from ten to twelve feet in length, having a vertical rule attached to it, to which a line and plummet are suspended, and the use of which is to try the level of walls at various stages o the building as it proceeds, and especially, at window-sills, foundations and wall-plates; the large square, employed for the setting-out of a side of a building at right angles; the rod, usually either five or ten feet in length, and used for measuring lengths; the jointing-rule, about eight feet in length and four inches in hreadth, with which the operator runs or marks the centre of each joint of the brickwork; the jointer, an iron tool shaped somewhat like the letter S, and employed with the preceding tool for marking the joints; the compasses, for traversing arches and vaults; the raker, a piece of iron having two knees or angles, the points of which are employed for removing decayed and old mortar from the joints of old walls, previously to repointing them; the hod, with which I doubt not my readers are sufficiently acquainted as not to necessitate a description here, and with which the brick-layer proper seldom has anything to do, the helper usually having charge of this.

Among other tools required are the line-pins and line, for the regulating of each course of bricks, the rammer, an iron crow and pickaxe, grindstone, hammers, etc., these not being requisite for each individual bricklayer employed on a job, but rather as being included in the apparatus at command generally. When it is required to prepare and cut gauged arches, the following appliances in addition will be required: a banker, which consists of a bench from six to twelve feet in length, from two-and-a-half to three feet in width, and about three feet in height; a camber-slip, which consists of a piece of wood about half an inch in thickness, having one edge curved, and rising about one inch in six feet, and which is employed for the drawing of the soffit-line of straight arches. When the lower edge is curved, it rises to the extent of half an inch in six feet for the purpose of drawing the upper line of the arch, so as to prevent its getting hollow by settling. The upper edge is not invariably cambered, and when the slip is sufficiently long, it answers for the width of a variety of openings; a rubbing-stone, a rough-grained stone, which is fixed on a bed of mortar at one end of the banker, the gauged bricks being rubbed smooth on this stone; a bedding-stone, consisting of a piece of marble nearly a couple of feet in length, of about ten inches in width, and of any convenient thickness, its use being to try the rubbed surface of a brick upon, so that the brick may fit truly upon the skew-back or leading-end of an arch; a square, for testing the bedding of the bricks and the soffits; a bevel, for drawing the soffit-line on the face of the bricks; a mould, for forming the face and back of the brick, used in order to reduce it to its proper taper, this mould having a notch for every brick of the arch; a scribe, which can be made out of a sharp nail or bit of thin iron; a tin saw, necessary for cutting the soffit-lines about an eighth of an inch deep, first, by the level edge on the face of the brick, then, by the square edge on the bed, in order to enter the brick-axe, and prevent the brick from spalling. The saw is likewise employed for cutting the soffit through its breadth in the direction of the tapering lines upon the face and back edge, and also for cutting the false joints of headers and stretchers; a brick-axe, for axing off the soffits of bricks to the saw cuttings and the sides to the lines drawn by the scribes, and the truer the bricks are axed, the less rubbing will they require; a templet, employed for taking the length of the stretcher and the width of the header; a chopping-block, for reducing the sizes and forms of bricks, and generally made out of a piece of rough wood six or eight inches square; and a float-stone, used for rubbing curved work smooth, such as the cylindrical backs and spherical heads of arches, which will complete the outfit of the bricklayer.

Although many of these appliances have now been done away with through the introduction of machinery, still I have thought it quite as well to give them a place, as, in a new country especially, there may be times and places when the "resources of civilization" in the shape of machine-made bricks turned-out to any and every design and fashion would not be available, and where, consequently, the processes which found favor with our forefathers would not be unacceptable. Therefore, though old-fashioned, I trust the foregoing will not be unacceptable to my younger readers, upon whom I would impress that they can never acquire too much knowledge, as portions of it, at least, are bound to be remembered, and to crop up for application practically when least expected.

It will not be out of place, I think, if I make a few remarks upon the general descriptions of bricks in use, as it is quite as important for an artificer to know what he is working *with* as to know how to work with it, and although to my older readers I shall be going over well-trodden ground, still to the younger members of my *clientèle* such will not be the case. I shall, of course, avoid all technicalities, and I shall not give the chemical composition of those slabs of baked clay, known from the time of the ancient Egyptians, but shall simply confine myself to bricks as we find them.

Foremost among these must, of necessity, be placed the old-fashioned stock-bricks,[1] which are employed for internal walls and foundations, and which bricks are divided into several classes — best malms for rubbers, second malms for facing, and malm paviors or shippers for facing or paving, these last being admirably adapted, from their hardness and soundness, for export. The earth employed in the manufacture of these is passed through a wash-mill, to free it from any stony and gritty impurities, and consequently the bricks are of a very superior quality. Then come picked stocks, common stocks, rough stocks, grissels, places, shuffs, and burrs.

In the first instance, these classes are not made as such, the classification taking place after they have passed through the process of burning, which does not take place in kilns, like others, but in what is known as a clamp, and it is while the breaking-up of the clamp is going on that the bricks are classified. It is from the peculiar nature of the ingredients of which they are composed that these bricks actually burn each other, the only fuel used being a few layers of cinders, these layers being placed between the rows or holts of green bricks when being stacked in the clamp. As may be imagined, the various degrees of burning decide their respective classes, the first being the shuffs. These are of least value, often falling to pieces in the handling. Next come the places, which are a trifle sounder. Then follow the grissels, which, though better baked, have not taken the heat uniformly, and after these come the common stocks, which, though still better baked, are yet more or less imperfect. Then follow the picked stocks, which are the best with the exception of the washed stocks. The rough stocks are those which, having become so calcined and knocked out of shape through the concentration of the heat, are of no avail in walls, but which can be used in foundations or in the centre of very thick walls, and even then they are not very desirable. Next come the burrs, which are blocks consisting of from two to a dozen bricks welded together, and which come in very handily for rockwork in pleasure-gardens, or for rough walls. Then of the most superior description, namely, the washed stocks, there are malms, malm-seconds, and paviors. The first of these three are the very finest of all stock-bricks. They are of a warm yellow or buff color, and, from the mild nature of the earth from which they are manufactured, they are fitted for cutting and rubbing in gauge-work, though even for this they are not without a fault, this being the numerous small air-cells formed in the body of the brick during the process of burning. The second of the bricks mentioned above — the malm paviors or shippers — are those selected from the malms and seconds on account of being burnt too hard to be used as cutters, and too dark to be employed with the seconds as facing bricks, but they make capital facings when used entirely by themselves. They are also very durable, and will sustain almost unlimited pressure in piers and walls. Red bricks, kiln-burned, of late years, have been very extensively employed in England, owing largely to the revived taste for Queen Anne architecture, but, owing to their great cost, are seldom employed for other than facings. I now come to the white kiln-burned bricks, which, owing to their great absorbent qualities, are ill suited to large cities or manufacturing centres.

I come now to gaults, which, like stocks, are divided into classes, the best being known as number one. These are, in a certain stage of dryness, between the time of moulding and burning, passed through a die, which has the effect, by the use of a very powerful press, of compressing the still yielding clay into a more regular and symmetrical form, which they will retain when burnt. They are usually reserved for facing. Then there are the pinks, so named from the color they assume when burning. They are very sound bricks, and make excellent and durable work, and their only difference from number two is the color. Before using, they should be saturated thoroughly in a tub, except in winter, when there is a danger of frost attacking them. These bricks are perforated, each brick having a number of circular holes passing through it, these being effected by a machine in the moulding. They are not fitted for sound work, as they are liable to twist in the burning. They are classed as whites and pinks. A very durable brick, and employed very extensively locally, are the Staffordshire blues, which are capable of sustaining a tremendous weight when used in walls and piers. There are many other kinds of bricks used, but as they are more or less of a fancy description, and as, also, the preceding include the whole of the standard bricks, it is not necessary here to refer further to them.

Of the materials used in mortar, the first, and, perhaps, the most important is lime, all varieties of which are very similar in their action. One of the most common is the gray-stone lime, large quantities of which are used in England. One of the most powerful materials is the blue-lias lime, which possesses the advantage of setting under water, and hence is sometimes termed hydraulic lime.

[1] As these definitions may be of use in interpreting the language of the many English text-books used in this country, we let them stand. — EDS.

It is principally found in Warwickshire and the west of England. Another lime is the white-chalk, which should really only be employed for plastering purposes. A lime which is very extensively employed at the present day, and is known as selenitic lime, originally known I believe, as Scott's cement. It requires very great care in manipulation, and nicety in the addition of the extraneous chemical ingredients, and, although when properly made, it is exceedingly effective, it is more often used for plastering than bricklaying, the workman in the latter craft not caring to take the necessary trouble.

I would here remind my readers that too much care cannot be taken with lime, as the air is almost as destructive as wet, and if properly stored, its setting power would be much greater in brickwork than it generally is. Lime, it should be borne in mind, when not in use should be covered up. Although, in former times, when mortar was mixed by a larry, and later, when the pug-mill took the place of the larry, the best use was not made of the lime, such is now, with the steam mortar-mill, not the case, as the lime, as well as the other ingredients, are all thoroughly well ground up, being reduced to the very finest grains, this method of manipulation far excelling any other. In these mills the lime is thoroughly incorporated with sand before it has had time, as in older processes it would have had, to expand, consequently the expansion, if the mortar is used at once as it should be, takes place in the brickwork, so the settlement or shrinkage to which brickwork in mortar is always more or less subject is obviated, and as less water is required by this method of preparation, there is less moisture to evaporate, and, as a matter of course, the mortar sets quicker, and in wet or frosty weather the work generally is less liable to damage. By this method also greater results are obtained with a much smaller quantity of lime; the screening is entirely dispensed with, as the mill will crush anything and everything in the way of core; thus all waste is utilized (too much so, in fact, by some unscrupulous builders) and in some instances sand is entirely dispensed with, not, however, I think, wisely. Where sand cannot be obtained and clay can, an excellent mortar is made by converting the clay into what is known as burnt ballast, this being afterwards pulverized in the mill with the necessary quantity of lime.

It will be understood from the foregoing that very much of the success in bricklaying depends upon the mortar, while this in its turn largely relies upon complete and thorough mixing and amalgamation. Before quitting the subject of mortar, I must say somewhat respecting sand, which is of equal importance with lime, for be the last-named ever so powerful, its power is minimized as the former is impure. Sand intended for mortar should be quite clean and of a sharp grit — river-sand being generally considered the best, pit-sand coming next. The sands employed for mortar are very numerous, but the builder must bear in mind that all those of a loamy description must be well and repeatedly washed before using, or it will not make good mortar.

Proceeding now with the actual process of brick-laying, I would impress upon the student that in the raising of brick walls, it is imperatively a necessity to have good, solid foundations. For all these trenches should be dug, and the ground tried with a rammer or a hammer in order to ascertain its general soundness. If the ground should appear to shake, it should be bored with a well-sinker's drill, in order to ascertain whether the looseness be local or general. Should the soil prove to be firm, the looser parts, if not very deep, must be dug up, until a bed of solid earth is reached. But should the ground not be very loose, it may sometimes be made sound and stable by ramming into it large blocks of stone, these being closely packed together and filled-in with smaller ones; but should the ground turn out to be very bad, especially if marshy, it must be piled and planked, when, in such cases, concrete will be found to be about the best material to employ. On rising ground, the foundation must be made in a series of steps. When the ground is loose over which it is intended to make windows, doors, etc., while the ground at the sides upon which the piers are to stand is firm, it is usual to turn inverted arches under such openings. This is a very necessary precaution in all instances where the depth of the wall below will permit of it, as the piers in settling will carry the arch with them, and, by compressing the ground, assist in securing a good structure. These arches should be turned with great exactness, and their height should be at the very least half their width. The beds of the piers ought to be as uniform as possible, for, although in some cases the bottom of the trench may be very firm, yet, if it vary at all in solidity, the piers will settle more in one place than in another, and thus cause a vertical fracture in the superstructure. If the solid portions of the trench are beneath the openings which it is intended to have, and the softer portions of the earth are where the piers are to be built, arches not inverted, must be suspended upon the firm ground, between them, and in such a case as this, great attention must be paid to the insisting pier, whether it cover the arch or not, because if the middle of the pier rest over the middle of the summit of the arch, the narrower the pier is, the greater should be the curvature of the arch at its apex. In the case of suspended arches, the intrados of the arch ought to be quite clear in order that the arch may have its full effect. In this case, also, the ground upon which the piers are erected should be of equal firmness, as otherwise the building is liable to be injured through unequal settling, which is far more injurious than when the ground, from being uniformly of a soft and sinking nature, permits of the piers descending equally, in which case the structure sinks as a whole, and no damage results.

Passing from piers, I come to foundations, in ramming which, the stones employed should be previously chopped or hammered up, and then laid of a breadth proportionate to the weight which it is intended to put upon them, and finally rammed close together by means of a heavy rammer. As a general rule the lower layer of stones may project for a foot on each side of the wall intended to be raised, and on this bed another course may be placed, so as to bring the upper bed of stone upon a general level with that of the trench, which should project about eight inches on each side of the wall, each course receding four inches. The joints of every upper course must fall as nearly as possible on the middle of the stones in the course immediately beneath it — this being a rule that should be invariably followed in all kinds of walling, the object being to obtain the greatest lap one upon the other. The strength of all brickwork depends upon the manner in which the bricks are laid, the practice in England being generally confined to old English bond and Flemish bond. In the former a row of bricks laid lengthwise on the length of the wall is crossed by a row with its breadth in this length, and so on alternately. The courses in which the lengths of the bricks are disposed through the length of the wall are known as stretching-courses, and the bricks as stretchers. The courses in which the lengths of the bricks run in the thickness of the walls are known as heading-courses, and the bricks as headers. The Flemish bond, consists in placing a header and stretcher alternately in the same course, and though the effect is more pleasing, the mode is not so durable. In a nine-inch wall, it is usual, in the English bond, to prevent two vertical joints from running over each other at the end of the first stretcher from the corner, to place the return corner stretcher, which becomes a header in the face that the stretcher is in below, and occupies half its length; a quarter-brick is placed on the inside, so that the two extend to six three-fourth inches, leaving a lap of two one-fourth inches (to make up the nine inches) for the next header, which lies with its middle upon the middle of the header below, and thus forms a continuation of the bond. The three-quarter bat thus introduced is known as a "closer." A similar effect can be produced by introducing a three-quarter bat at the corner of the stretching-course, and then the corner-header being laid over it, a lap of two one-fourth inches will be left at end of the stretchers below for the next header, which being laid, the joint below the stretchers will coincide with its middle and thus form the bond. In a fourteen-inch or brick-and-a-half wall, the stretching-course upon one side is laid so that the middle of the breadth of the bricks upon the opposite side falls alternately upon the middle of the stretchers and upon the joints between the stretchers.

In a two-brick wall, every alternate header in the heading-course is only half-a-brick thick on both sides, which breaks the joints in the core of the wall. In a nine-inch wall built according to Flemish bond, two stretchers lie between two headers, the length of the headers and the breadth of the stretchers extending to the whole thickness of the wall. In Flemish-bond walls there is a frequent splitting, and to prevent it laths or slips of hoop-iron are at times laid in the horizontal joints between the two courses. At other times diagonal courses of bricks are laid at certain heights from each other. Attempts have also been made to unite a complete bond with Flemish facings for the sake of the improved appearance which is thus gained, but it is not strong or at all satisfactory. The following rules for forming English bond, as given by that well-known authority, Mr. Nicholson, cannot be bettered: First, each course is to be formed of headers and stretchers alternately; second, every brick in the same course must be laid in the same direction; but in no instance is a brick to be placed with its whole length alongside of another; but to be so situated that the end of one may reach to the middle of the others which lie contiguous to it, excepting the outside of the stretching course, where three-quarter bricks necessarily occur at the ends, to prevent a continued upright joint in the face-work; third, a wall which crosses at a right angle to another will have all the bricks of the same level course in the same parallel direction, which completely bonds the angles.

When building a wall, the beginner should remember that the bricks should incline slightly towards the middle of the wall, in that one-half may act as a shore to the other. Walls are also very much strengthened by layers of hoop-iron being inserted between the courses. In winter-time all brickwork should be covered with straw and wood, to protect it from the alternate effects of rain and frost.

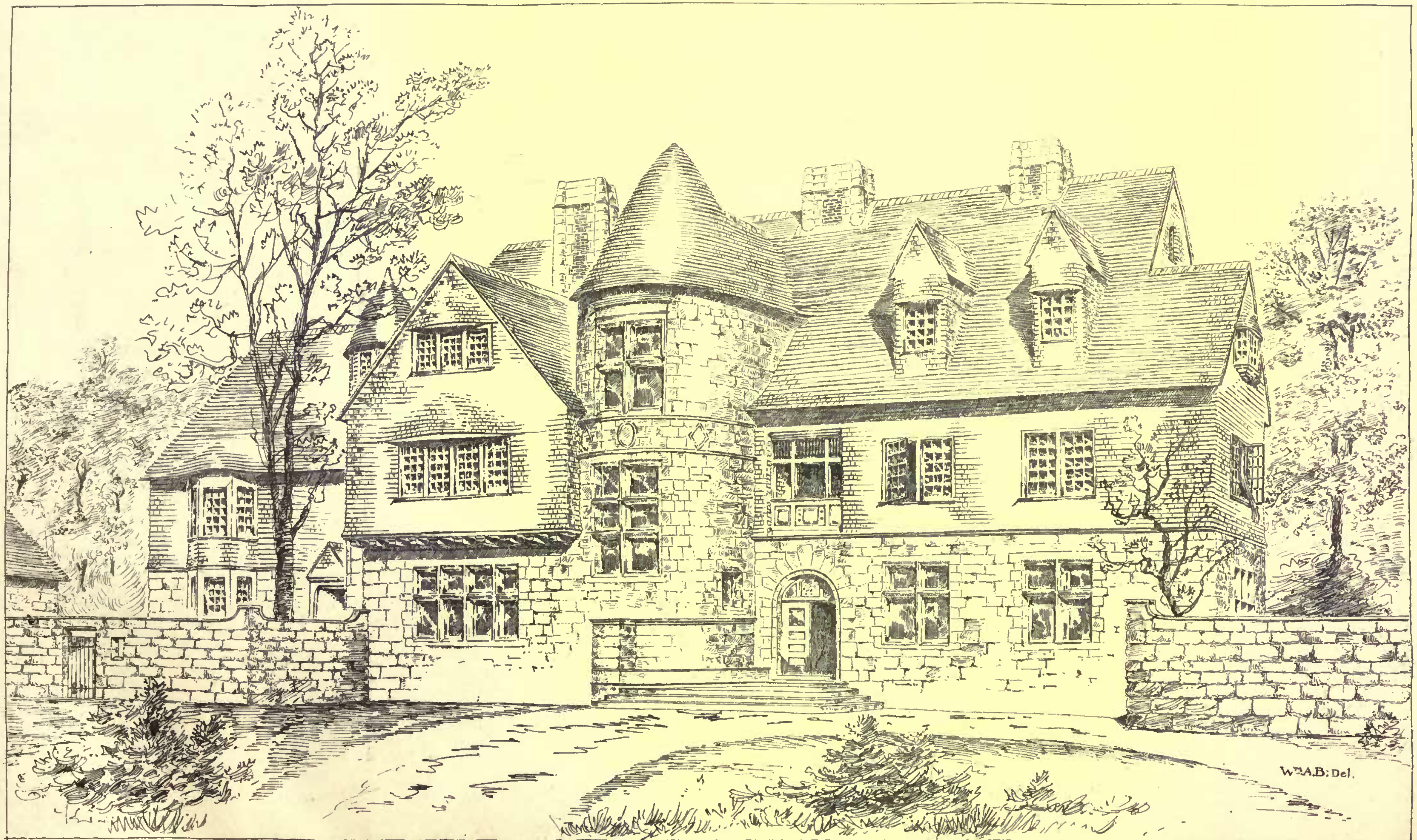
When a wall is finished, the joints of the bricks on the face, are sometimes filled up with mortar so as to present a neat and uniform appearance. This is known as pointing, of which there are two kinds, in both of which the mortar is well raked out, and filled up again with blue mortar, though in one kind, known as flat-joint pointing, the courses are simply marked with the edge of a trowel. If, beside this, plaster be inserted in the joints with a regular projection, and neatly pared to a parallel breadth, this is known as tuck-joint pointing.

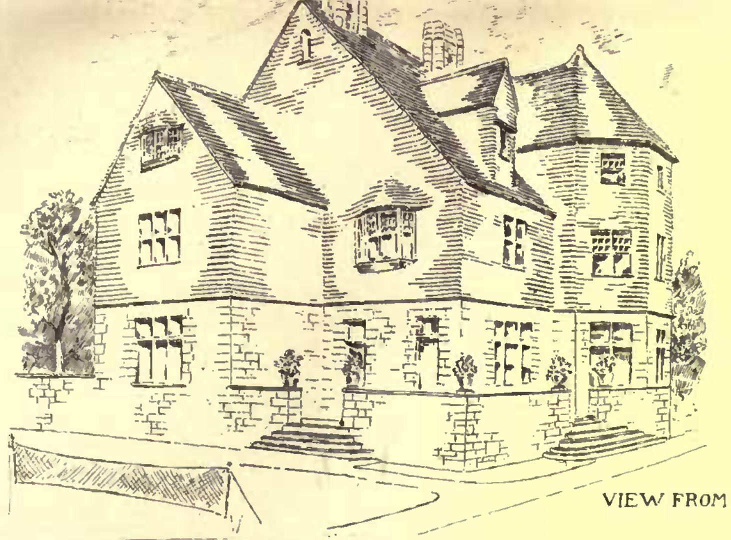
Groined arches are sometimes made of brick, being generally raised on centres formed of carpentry work. The turning of a simple arch on a centre only requires care in the keeping of the courses as close as possible, and to avoid the use of much mortar on the inner parts of the joints. The great difficulty in executing a brick groin arises from the peculiar method of making a proper bond at the intersection of the two circles as they gradually rise to the crown, where they form an exact point. In the meeting or intersecting of these angles, the inner rib should be perfectly straight



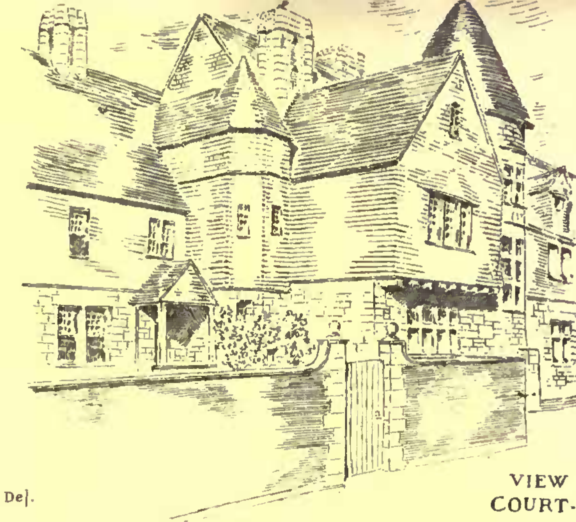
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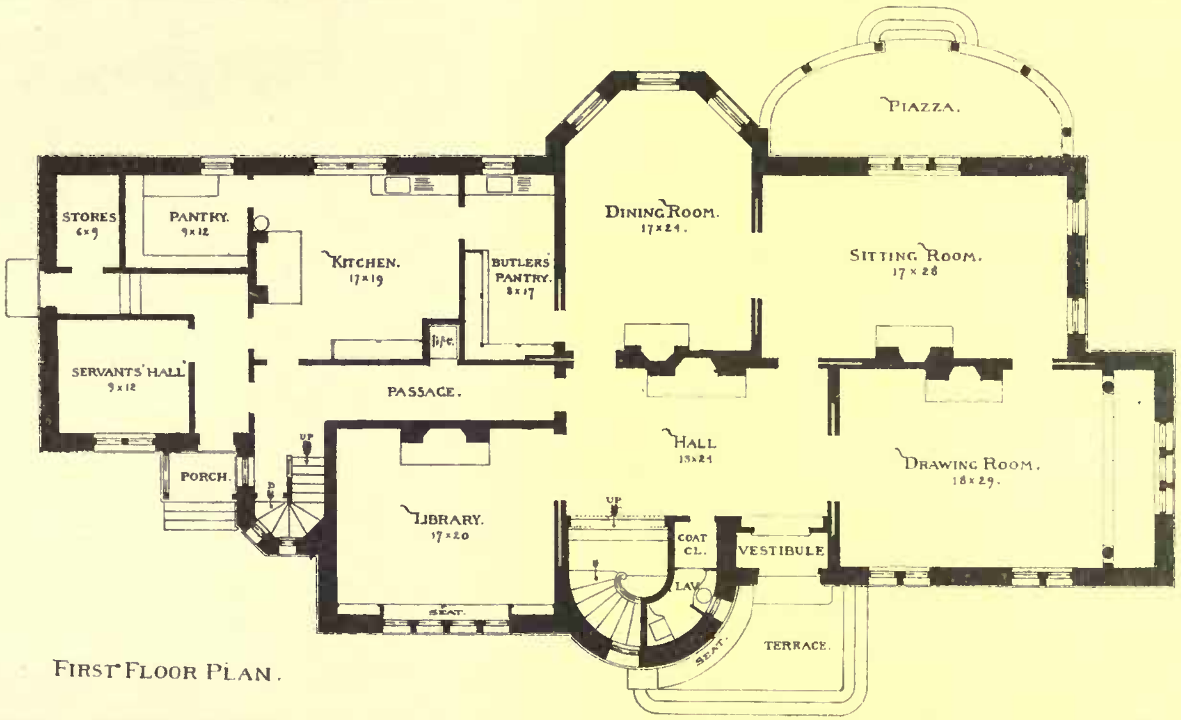

Wm A.B: Del.



VIEW FROM LAWN.



VIEW FROM COURT-YARD.



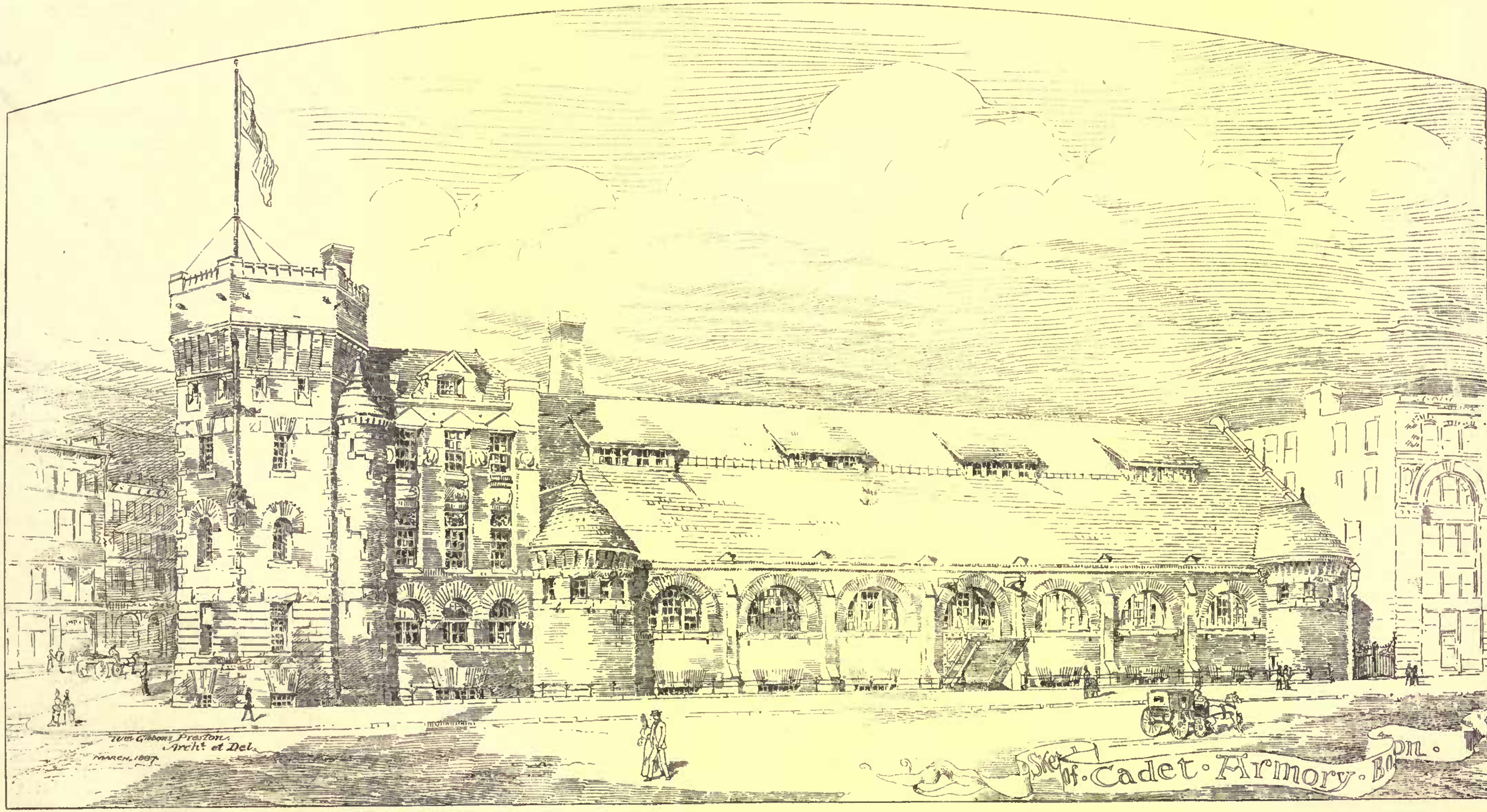
FIRST FLOOR PLAN.

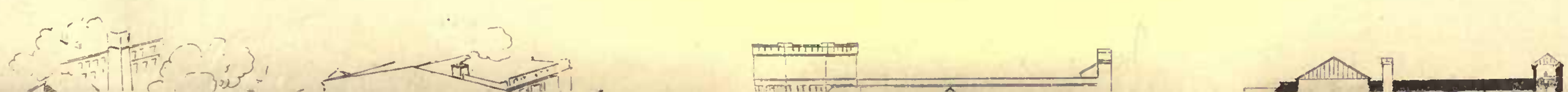
HOUSE IN DETROIT, MICH.

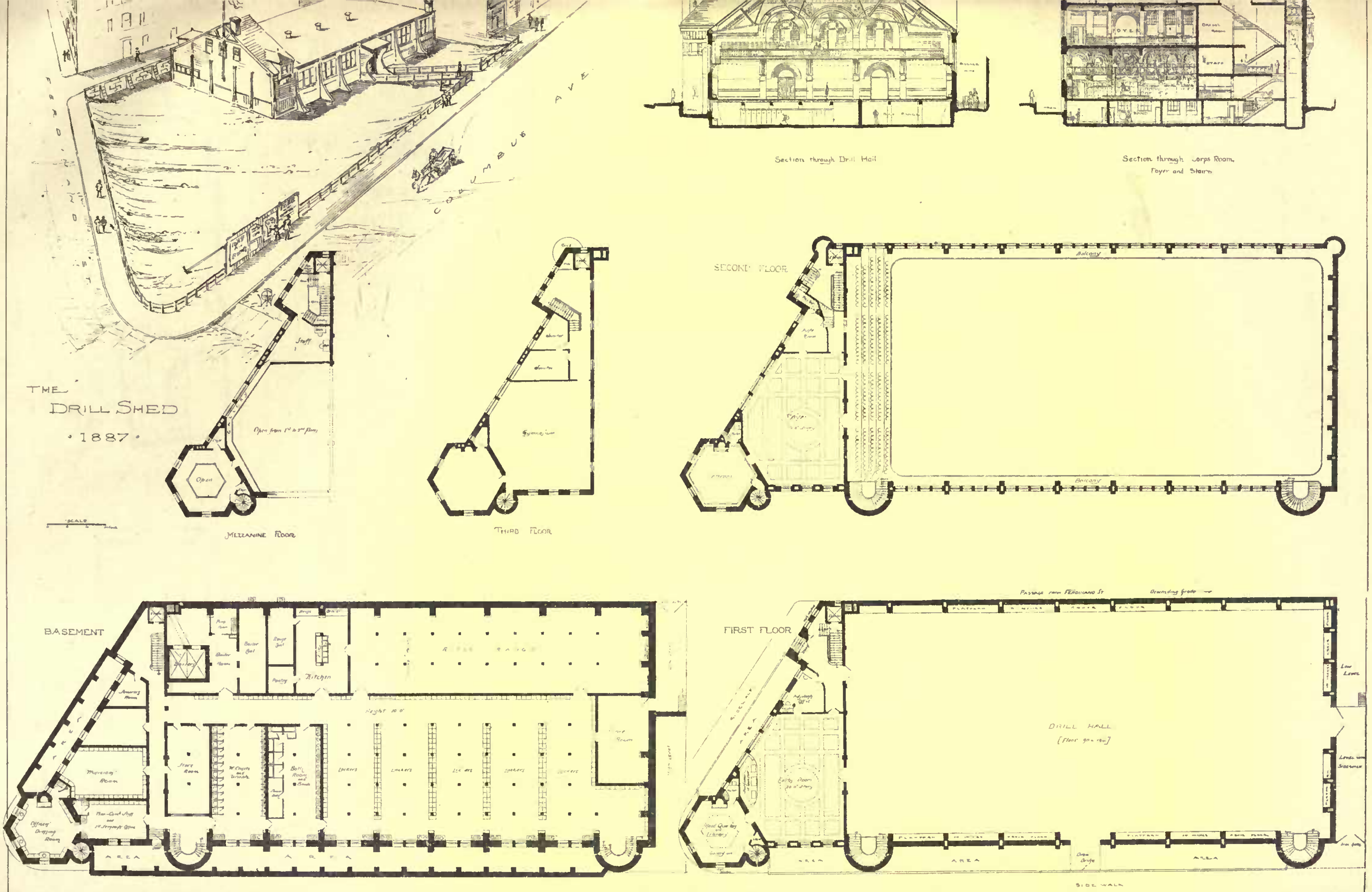
WILLIAM A. BATES, ARCH'T.

149 BROADWAY, NEW YORK.

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Wm Gibbons Preston,
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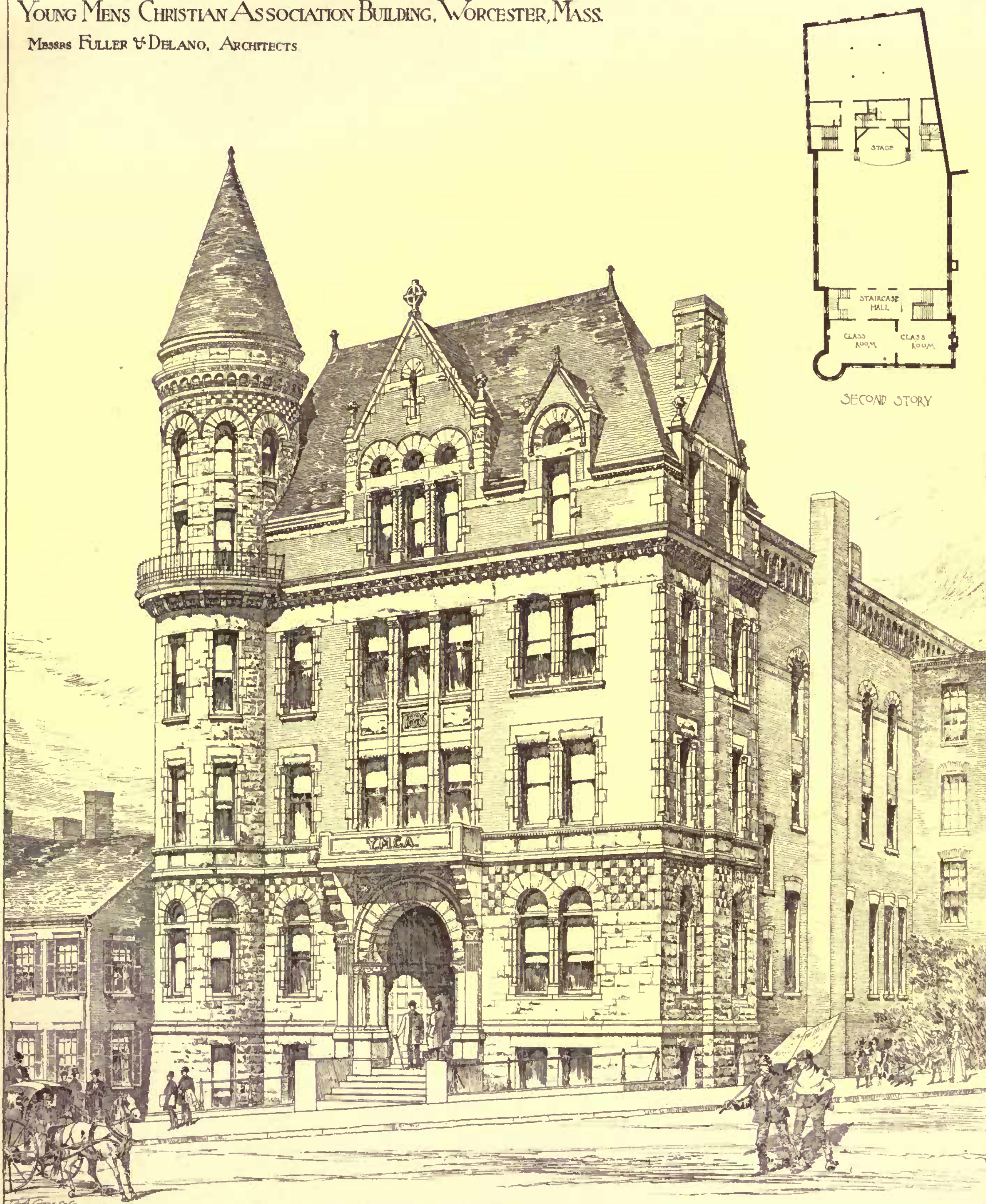




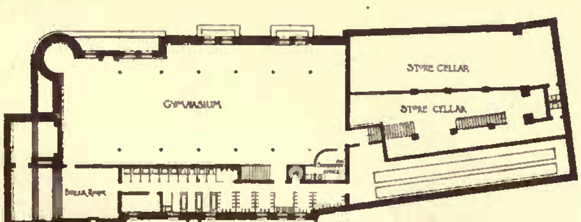
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YOUNG MENS CHRISTIAN ASSOCIATION BUILDING, WORCESTER, MASS.

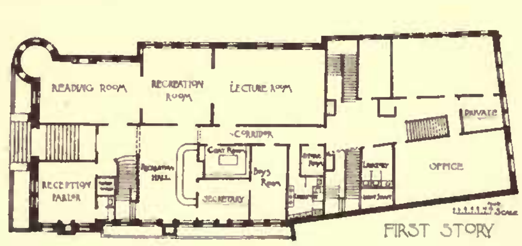
MESSRS FULLER & DELANO, ARCHITECTS



SECOND STORY



BASEMENT



FIRST STORY

Heliotype Printing Co Boston.

and perpendicular to a diagonal line drawn on a plan. After the centres are set, the application of the brick to the angle will show in what direction it is to be cut. The sides are turned as in common cylindrical vaults. The student will find that a variety of ornamental brick cornices can be formed by cutting and changing the positions of the bricks employed, while others can be formed by chamfering only. Perhaps the most difficult portion of bricklayers' work is the constructing of niches, the difficulty arising from the thinness to which the brick must be reduced at the inner circle, as they cannot extend beyond the thickness of one brick at the crown or top, it being customary to make all the courses standing, whereby much neatness is obtained. With this my remarks upon bricks and bricklaying must terminate. W. N. BROWN.

[To be continued.]

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

A DINING-ROOM INTERIOR. MR. CHARLES A. GIFFORD, ARCHITECT, NEWARK, N. J.

[Gelatine Print, issued only with the Imperial Edition.]

ARMORY FOR THE FIRST CORPS OF CADETS, M. V. M., BOSTON, MASS. MR. WM. GIBBONS PRESTON, ARCHITECT.

THE Cadet Armory is located on a lot about 112' x 250' on Columbus Avenue and Ferdinand Street. Passage-ways bound the other two sides of the building, so that it is detached and isolated. The building is to be so constructed that by raising the draw-bridge and closing heavy iron shutters on all windows, it becomes practically a fortress, where the corps can, if necessary, resist a protracted attack by a mob, or, in time of need, provide shelter and refuge for helpless citizens.

The building will be of brick and brownstone, and will comprise two portions, the drill-hall, 100' x 200', and the administration department, or "head house" baving a frontage of fifty feet on Columbus Avenue, and one hundred and twenty feet on Ferdinand Street.

A severe and simple castellated style has been adopted in the design, modified, as must all styles be, to meet the complex uses of a modern structure. The drill-hall is expressed by its low, long roof. It is lighted by windows high up in the walls, protected by musket-proof iron shutters. The roof is supported by iron trusses and the nterior walls are to be of buff glazed-bricks. Beneath the drill-hall are the company dressing-rooms, bath-rooms, heating-apparatus, armory, rifle-ranges, store-rooms, etc. The stairways connecting the gallery which surrounds the drill-hall with the main floor and the basement are located in the semi-circular bays — and they are also provided with loop-holes, properly placed for flank defence of the area, ten feet in width, giving light and air to the basement. The "head house" is marked by an hexagonal tower at its angle. In the upper part of the tower will be located a great water-tank, and from its roof the flag-signal corps can communicate with the State House or other elevated buildings. In the "head house" are the corps-room, about 40' x 40', headquarters, library, Veteran Association's rooms, gymnasium, store-rooms, janitor, etc.

An elevator gives access to all stories. The main stairway is reached from the Ferdinand-Street side, and a supplementary, private stair is in the small circular bay, adjoining the tower. Every precaution will be taken against injury by fire, and the intention is to make the armory a model of its kind.

A portion of the foundations is already in place, and the work will be pushed forward as rapidly as circumstances warrant.

OFFICE OF THE NEW YORK LIFE INSURANCE CO., ST. PAUL, MINN. MESSRS. HODGSON & STEM, ARCHITECTS, ST. PAUL, MINN.

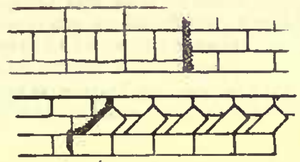
THE structure is entirely fireproof, and the intention is to use Georgia marble for the first three floors, and St. Louis fire-bricks for the remainder, trimmed in terra-cotta of the same character as the bricks.

BUILDING OF THE YOUNG MEN'S CHRISTIAN ASSOCIATION, WORCESTER, MASS. MESSRS. FULLER & DELANO, ARCHITECTS, WORCESTER, MASS.

HOUSE AT DETROIT, MICH. MR. W. A. BATES, ARCHITECT, NEW YORK, N. Y.

TO MEND A BROKEN STEAM-PIPE.—The *Mechanical News* describes an ingenious means of repairing a break in a steam-pipe: "The break is bound with wood strips laid close together, and well 'served' around with stout cord or rope. Endwise separation is prevented by more rope crossing the break diagonally, and tied so as to draw the broken parts together. When the wood and the cord get wet with the steam the joint is even tighter than before, for the wood swells and the cords shorten."

SAFE BUILDING.—XVI.[1]



Figs. 78 and 79.

Brick facings. BRICK facings, as laid up in this country, usually consist of all stretchers. Every fifth or sixth course is bonded into the backing, either by splitting the brick in two, as shown in Figure 78, and using short headers behind it, or by breaking off the rear corners, as shown in Figure 79, and using diagonally-laid bond-brick.

The latter course is the better, but there is no strength in either; particularly as, as a rule, the front brick are so much softer and weaker than those in the backing.

The English bond, in which a course of headers alternates with a course of stretchers, is much to be preferred; or, better yet, the Flemish bond, where in each course a header alternates with a stretcher. Of course, in both English and Flemish bond, if the front brick are thinner than the bricks used in the backing, larger and more unsightly joints will be necessary in front.

Regular work the best. It is best, as a rule, not to count on the front work for strength. We frequently see masons laying up brick walls by first laying a single course of headers or stretchers on the outside of the wall, and then one on the inside, and then filling the balance of wall with bats and all kind of rubbish. This makes a very poor wall. The specification should provide that no bats or broken brick will be allowed, leaving it to the architect's discretion to stop their use, if it is being overdone; of course, some few will have to be used. But, after all, the best wall is that one which is built the most regularly and with the most frequent bonds, and no architect should be talked out of good, regular work, as being *too theoretical*, by so-called "practical" men. The necessity for regularity and bond is easily illustrated by taking a lot of bricks of different sizes, or even toy blocks, and attempting to pile them up without regularity; or, even if piled regularly, without bond. It will quickly be seen that the most regular and most frequently-bonded pile will go the highest. By "bond" is meant alternating headers and stretchers with regularity, and so as to cover and break joints.

Use of bond-stones. The use of "bond-stones" *at intervals only* is bad; they should be carried through the whole surface (width and length) of wall and be of even thickness, or else be omitted. Using bond-stones in one place only tends to concentrate the compression on one part of the wall. Thus, bond-stones built under each other at regular intervals, as shown in Figure 80, are bad, as they give the pressure no chance to spread, but keep concentrating it back onto the part of wall between the vertical lines A and B, whereas, in Figure 81, the pressure is allowed to spread gradually over a larger area of the wall. Where, however, a heavy girder, column or other weight comes on a wall, it is distributed by means of a large block, generally granite or stone, or sometimes by a large iron plate.

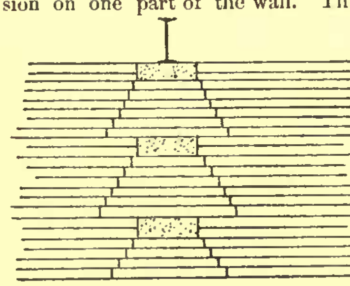


Fig. 80.

The block or plate should have sufficient area not to crush the brick-work directly under it. Where girder-ends are built into walls, it is also desirable to build a block *over* the girder-end as well as under the same. The upper block prevents any part of the wall from resting on the girder or being affected by its shrinkage, if of wood; if the girder is of iron, the upper block will wedge in the girder-end more firmly, and the girder will be able to carry more load. See page 63, No. 554 (Table VII).

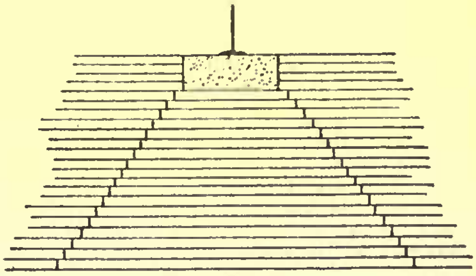


Fig. 81.

Metal anchors. Anchors for girders and beams are usually made of iron and of such shape as to allow the girder or beam to fall out in case of fire. Anchors made of iron are not objectionable in inner walls, or where not exposed to dampness; all iron should be thoroughly painted, however, with red lead or metallic paint. Before painting, all rust should be scraped off. Don't believe the "practical" man who says the paint will stick better if you leave the rust on the iron; it will stick better to the rust, no doubt, but not to the iron. For outside work all iron should be galvanized; but it is better to use copper for anchors, dowels, clamps, etc. All copings should be clamped together, the clamps being counter-sunk. Slanting-work and tracery should be dowelled together. Where iron is let into stones, and run with lead or sulphur, the iron is apt to swell with

[1] Continued from No. 593, page 226.

rust or heat and burst the stone. Dampness in walls is one of the worst dangers, both on account of frost and decay.

Drip-moulds. All exterior mouldings and sills should be projected and have "drip-moulds" cut underneath, to cause the water to drop or drip; this will prevent considerable dampness and keep the outside surface of the wall from becoming dirty, as the dust lodging on top of mouldings discolors the rain-water, and the latter, instead of streaking down the wall, will drop off.

Hollow walls. Walls are frequently built hollow to prevent dampness, but this raises many objections. Shall the inner or outer wall be the thicker? If the outer wall, then all beams, etc., have to be that much longer, so as to rest on the stronger part; they are liable to transfer dampness, and then, too, the thicker, and, consequently, greater, part of wall is exposed to dampness. If the inner wall is thicker, the construction, so far as beams, etc., are concerned, no doubt is better, but the outer part is apt to be destroyed by the frost. Then at windows and doorways both must be connected, and dampness is apt to get through. It is well to ventilate the air-space between walls, at the bottom from inside and at the top from outside. The bottom of spaces should be drained. Tops of arches, or lintels over openings, should be cemented and asphalted (in the air-space), to shed any dampness settling on them. The outer and inner walls should be frequently anchored together. Iron anchors galvanized, or copper anchors are best; they should have a half-twist, as shown, to prevent water running along them.



Fig. 82.

Care must be taken to keep hollow walls free from hanging mortar, which will communicate moisture from one wall to the other.

But hollow walls are not nearly so good as solid walls with porous terra-cotta furrings.

Where walls are coped with stone, there should be damp-courses of slate or asphalt under same, and the back side should be flashed, to prevent dampness descending. If gutters are cut in stone cornices, they should be lined with metal, preferably of copper, the outer edge being let into a raggle and run in with lead.

Underpinning. When a wall, already built, has to have its foundations carried down lower, it is called "underpinning the wall." Holes are made through the wall at intervals and through these (at right angles to the wall) are placed the "needles," that is, heavy timbers, which carry the weight of the wall. Where the needle comes in contact with the wall, small cross-beams are laid on its upper side, and wedged and filled with mortar, to get a larger and more even bearing against the wall. At the inner and outer ends of the needles heavy upright timbers are placed underneath, running down to the new, lower level. The foot or ground bearing of these timbers is formed by heavy planks crossing each other, to spread the weight over more ground; wedges are driven under the feet of the uprights, till the ends of the needle are forced up, and the centre of the needle shows a decided downward curve of deflection, indicating that the weight of wall is on the needle. Frequently jack-screws are used in place of wedges, to get the weight onto the uprights. As soon as the needles carry the weight of wall, the intermediate portions of wall are torn out and the excavating to the lower level begins. If the soil is loose, sheath-piling must be resorted to on each side of wall. Frequently the feet of the uprights are "cribbed," that is, sheath-piled all around, to hold the ground under them together and keep it from compressing. The new wall is built up from the lower level between and around the needles. On top of the new wall two layers of dressed-stone are placed filling up between the old and new work. Between these stones iron wedges are driven in opposite pairs, one from the inside and one from the outside. These wedges must be evenly driven from both sides or the wall might tip. These wedges are driven until the weight of the wall is on them and off the needles.

This is readily seen, for the needles straighten out when relieved of the load. The jack-screws are now lowered or the wedges under the uprights eased up; the uprights taken away, needles removed, and the holes filled up. Underpinning operations must be slowly and carefully performed, as they are very risky. If there is any danger of a wall tipping during the operation, grooves are cut into the wall and "shores" or braces placed against it. The feet of the shores rest on cross-planks, same as uprights, and are wedged up to get a secure bearing of the top of the shore against the wall. Where the outside of a wall cannot be got at, "spring needles" are used from the inside. That is, the one end of the needle acts as a lever and supports the wall, while the other, inner end, is chained and anchored down to prevent its tipping up.

Strength of bricks. The strength of a wall depends, of course, largely on the material used. A good, hard-burned brick, well laid in cement-mortar, makes a very strong wall. To tell a good brick, first examine the color; if it is very light, an orange-red, the brick is apt to be soft. If the brick is easily carved with a knife, it is soft. If it can be crushed to powder easily, it is soft. If two bricks are struck together sharply, and the sound is dull, the bricks are poor; if the sound is clear, ringing, metallic, the bricks are good and hard. If a brick shows a neat fracture, it is a good sign; a ragged fracture is generally a poor sign. The fracture also shows the evenness of the burning and fineness of the material. A brick that chips and cannot be cut easily is a good brick. The darker the brick, the harder burned. This, of course, does not hold good for artificially-colored bricks. The straighter and more regular the brick, the softer it is (as a rule), as hard-burning is apt to warp a brick.

What has been said of the strength of bricks holds good of terra-cotta. The latter should be designed to be of same thickness, if possible, in all parts, and any hollows caused thereby must be filled-in solid. It is best to fill-in the hollows with bricks and mortar several days in advance, and let the filling set, so as to be sure it will not swell up afterwards and burst the terra-cotta.

Strength of stones. To judge of the strength and durability of stones is a more difficult matter. If the stone be fractured, and presents, under a magnifying glass, a bright, clear, sharp surface, it is not likely to crumble from decay; if the surface is dull-appearing and looks earthy, it is likely to decay. Of course, samples can be tested for their crushing and tensile strengths, etc. And we can tell somewhat of the weathering qualities by observing similar stones in old buildings; much, however, depends whether the stones come from the same part of the quarry. Another test is to weigh different samples, when dry; immerse them in water for a given period, say, twenty-four hours, then weigh them again, and the sample absorbing the least amount of water (in proportion to its original weight) is, of course, the best stone.

Another test is to soak the stone in water for two or three days and put it out to freeze; if it does not chip or crack, it will probably weather well. Chemical tests are made sometimes, such as using sulphuric acid, to detect the presence of lime and magnesia; or, soaking the stones in a concentrated boiling solution of sulphate of soda; the stones are then exposed to the air, when the solution crystalizes in the pores and chips off particles of the stone, acting similarly to frost. The stones are weighed before and after the tests, the one showing the least proportional loss of weight being, of course, the better.

If stones are laid on their natural beds, however, little need be feared of the result, if the stone seems at all serviceable. The main dangers to walls are from wet and frost. Very heavy and oft-repeated vibrations may sometimes shake the mortar-joints, but this need not be seriously feared, in most cases; machinery may often cause sufficient vibrations to be unpleasant, or even to endanger wood or iron work, but hardly well-built masonry. Of course, the higher a building is, the greater will be the amount of vibrations and their strength. For this reason it is advisable to place the heaviest machinery on the lowest (ground) floor. The beds of such machinery should be as far

Machinery foundations. as possible from any foundations of walls, columns, etc., and the beds should be independent and isolated from all other masonry. Malo, in *Le Génie Civil*, recommends the use of asphalt for machinery-foundations, as they take up the vibrations and noise, and are as solid as masonry, if properly built. His claim seems well founded, and has been demonstrated practically; the asphalt foundation not only preventing vibrations but stopping the sound. A wooden form is made, covered inside with well-greased paper; into this are placed slightly-conical shaped wooden bars and boxes, also covered with well-greased paper, which are secured in the places to be occupied by the bolts and bolt-heads, and arranged for easy withdrawal. A layer of melted asphalt a few inches thick is then poured into the mould; over this are dumped heated, perfectly clean, sharp, broken stones and pebbles, rammed solid, the pebbles filling all interstices; then more asphalt is poured in, then another layer of stones and pebbles, etc. It is claimed that this foundation becomes so solid that it will not yield enough to disarrange the smooth running of any machinery, while its slightly-elastic mortar, besides avoiding vibrations and noise, prolongs very much the durability and usefulness of the

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GLOSSARY OF SYMBOLS.—The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.:—

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_1 = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
𝔡 = *diameter*, in inches.
𝔯 = *radius*, in inches.
π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{I}, a_{II}, a_{III}, etc., or b, b_{I}, b_{II}, b_{III}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance:—

m = moment or bending moment at *centre*.
m_A = " " " *point A*.
m_B = " " " *point B*.
m_X = " " " *point X*.
s = strain at *centre*.
s_B = " *point B*.
s_X = " *point X*.
v = stress at *centre*.
v_D = " *point D*.
v_X = " *point X*.
w = load at *centre*.
w_A = " *point A*.

machinery. Two dangers must be guarded against, viz., the direct contact of oil or heat with the asphalt. Stationary drip-pans guard against the former, while a layer of rubber, wood, cement, or other non-conductive material would accomplish the latter object. Where noise from machinery is to be avoided, a layer about one inch thick, of hard rubber or soft wood, should be placed immediately under the engine-plate. If this layer were bedded in asphalt the precaution would be still more effective.

Quality of asphalts. In all cases where asphalt is used, that with the least proportion of bitumen should be preferred.

Seyssell asphalt, which comes from France, is undoubtedly the best, and next to this comes the Swiss or Neuchâtel asphalt.

Trinidad asphalt, which is much used in this country, is much inferior, being softer and containing a larger proportion of bitumen or tar — a great disadvantage in many cases.

Openings over each other. In all walls try to get all openings immediately over each other. A rule of every architect should be, to make an elevation of *every* interior wall, as well as of the exterior walls, to see that openings come over each other.

Tower walls. It is foolish to make chimneys or tower-walls unnecessarily thick (and heavy), as they brace and tie themselves together at each corner, and, consequently, are much stronger than ordinary walls. Tower-walls, however, often require thickening all the way down, to allow for deep splays and jambs at the belfry openings. The chief danger in towers is at the piers on main floor, which are frequently whittled down to dangerous proportions, to make large door openings. In tall towers and chimneys the leverage from wind must be carefully considered.

Considering the importance of ascertaining the exact strength of walls, it is remarkable that so little attention has been paid to the subject by writers and experimenters. The only known rule to the writer is Rondelet's graphical rule, which is as follows:

Rondelet's rule. If A B (Figure 83) be the height of a wall, B C the length of wall without buttress or cross-wall (A B C being a right angle), then draw A C; make A D = to either $\frac{1}{8}$ or $\frac{1}{10}$ or $\frac{1}{12}$ of A B, according to the nature of wall and building it is intended for ($\frac{1}{12}$ for dwellings, $\frac{1}{10}$ for churches and fireproof buildings, and $\frac{1}{8}$ for warehouses); then make A E = A D, and draw E F parallel to A B; then is B F the required thickness of wall. The rule, however, in many cases, gives an absurd result. Gwilt's "*Encyclopædia of Architecture*" gives this rule, and many additional rules, for its modification. There are so many of them, and they are so complex, however, as to be utterly useless in practice. Most cities have the thickness of walls regulated by law, but, as a rule, these thicknesses give the minimum strength that will do, and where they do not regulate the amount and size of flues and openings, frequently allow dangerously-weak spots in the wall.

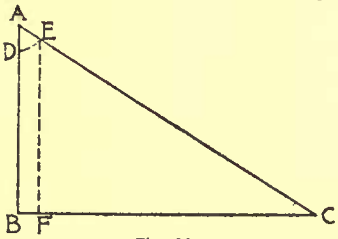


Fig. 83.

Formula for masonry. The writer prefers to use a formula, which he has constructed and based on Rankine's formula for long pillars, see Formula (3), and which allows for every condition of height, load, and shape and quality of masonry. In the case of piers, columns, towers or chimneys, whether square, round, rectangular, solid or hollow, the Formula (3) can be used, just as there given, inserting for ρ^2 its value, as given in the last column of Table I, using, of course, the numbered section corresponding to the cross-section of the pier, column or towers. By taking cross-sections at different points of the height, and using for l the height in inches from each such cross-section to the top, we will readily find how much to offset the wall. Care must be taken, where there are openings, to be sure to get the piers heavy enough to carry the additional load; the extra allowance for piers should be gotten by calculating the pier first as an isolated pier of the height of opening, and then by taking one of our cross-sections of the whole tower or chimney at the level where the openings are, and using whichever result required the greater strength.

Strength of piers, chimneys and towers. As it would be awkward to use the height l in inches, we can modify the formula to use the height L in feet. Further, we know the value of n for brick-work, from Table II, and can insert this, too; we should then have:

For brick or rubble piers, chimneys and towers, of whatever shape:

$$w = \frac{a.\left(\frac{c}{f}\right)}{1 + 0{,}475.\left(\frac{L^2}{\rho^2}\right)} \qquad (59)$$

Where w = the *safe total* load on pier, chimney or tower in pounds.

Where a = the area of cross-section of pier, etc., in square inches, at any point of height.

Where L = the height, in feet, from said point to top of masonry.

Where $\left(\frac{c}{f}\right)$ = the safe resistance to crushing, per square inch, as given in Table V.

Where ρ^2 = the square of the radius of gyration, of the cross-section, in inches, as given in Table I.

If it is preferred to use *feet and tons* (2000 lbs. each) we should have

$$W = \frac{A.\left(\frac{c}{f}\right)}{14 + 0{,}046.\left(\frac{L^2}{P^2}\right)} \qquad (60)$$

Where w = the *safe total* load on masonry, in tons, of 2000 lbs. each.

Where a = the area of cross-section of masonry, at any point of height, in square feet.

Where l = the height, in feet, from said point to top.

Where $\left(\frac{c}{f}\right)$ = the safe resistance to crushing, in lbs., per square inch, as given in Table V.

Where p^2 = the square of the radius of gyration, as given in last column of Table I, — *but all dimensions to be taken in feet.*

To obtain the load on masonry, include weight of all masonry, floors, roofs, etc., above the point and (if wind is not figured separately) add for wind 15 lbs. for each square foot of outside superficial area of all walls above the point.

Where towers, chimneys, or walls, etc., are isolated, that is not braced, and liable to be blown over-by wind, the wind-pressure must be looked into separately,

In regard to the use of $\left(\frac{c}{f}\right)$ the safe resistance, per square inch, of the material to crushing, it should be taken from Table V. So that for rubble-work we should use:

$$\left(\frac{c}{f}\right) - 100$$

And the same for poor quality brick, laid in lime mortar.

For fair brick in lime and cement (mixed) mortar, we should use:

$$\left(\frac{c}{f}\right) = 150$$

And for the best brickwork in cement mortar, we should use:

$$\left(\frac{c}{f}\right) = 200$$

If, however, a wall (or pier) is over 3 feet thick, and laid in good cement mortar, with the best hard-burned brick, and there are not many flues, etc., in the wall, we can safely use:

$$\left(\frac{c}{f}\right) = 250$$

If the wall (or pier) is over 3 feet thick, and there are no flues or openings, and the best brick and foreign Portland cements are used, it would be perfectly safe to use:

$$\left(\frac{c}{f}\right) = 300.$$

Example.

A tower 16 feet square outside, carries a steeple weighing, including wind-pressure, some 15 tons. The belfry openings, on each side, are central and virtually equal to openings 8 feet wide by 18 feet high each. There are 8 feet of solid wall over openings. What should be the thickness of belfry piers? The masonry is ordinary rubble-work.

Tower Walls. In the first place we will try Formula (60) giving strength of whole tower at base of belfry piers. The load will be: 4.(26.16 — 18.8 — 26.1$\frac{2}{3}$) = 892 superficial feet of masonry 20″ thick and weighing 250 lbs. per superficial foot = 223000 lbs. (see Figures 84 and 85): add to this spire and we have at foot of belfry piers:

Actual load = 253000 lbs. or = 126 tons.

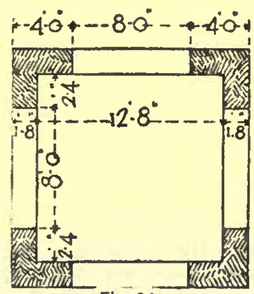


Fig. 84.

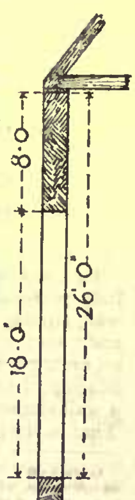


Fig. 85.

Now p^2 (the square of the radius of gyration) would be $p^2 = \frac{A}{I}$; the area $a = 16^2 - (12\frac{2}{3}^2 + 4.8.1\frac{2}{3}) = 43$ the moment of inertia $I = \frac{1}{12}.\ (16^4 - 12\frac{2}{3}^4 - 3\frac{1}{3}.8^3 - 8.16^3 + 8.12\frac{2}{3}^3) = 1799.$

Therefore $p^2 = \frac{1799}{43} = 41{,}8$. Now for rubble-work, Table V, $\left(\frac{c}{f}\right) = 100$; and, from Formula (60), the safe load would be:

$$W = \frac{43.\,100}{14 + 0{,}046.\frac{26.26}{41{,}8}} = \frac{4300}{14{,}77}$$

= 291 tons; or more than strong enough.

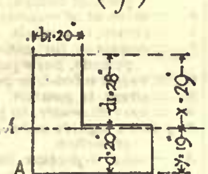


Fig. 86.

Piers at opening. Now let us examine the strength of each pier by itself, Figure 86. In the first place we must find the distance y of the neutral axis M–N from say the line A B. This from

Table I, Section No. 20 is:

$$y=\frac{\frac{48.20^2}{2}+20.28.\left(20+\frac{28}{2}\right)}{48.20+20.28}=18,''8, \text{ or say } y=19''.$$

Now $i=\frac{20.29^3+28.1^3+48.19^3}{3}=272347$ (in inches) and

$a=20.48+20.28=1520$ square inches, therefore $\delta^2=\frac{t}{a}=179$ (inches).

The length of each pier is 18 feet, or

$L=18.$

Therefore, from Formula (59) we have the safe load:

$$W=\frac{1520.100}{1+0.475.\frac{18.18}{179}}=81940 \text{ pounds,}$$

or say the safe load on each pier would be 41 tons.

The actual load we know is $\frac{126}{4}=34\frac{1}{2}$ tons, or the pier is more than safe.

Thickness of walls. Now let us see how far down it would be safe to carry the 20″ walls. We use formula (60) and have from Section Number 4, of Table 1:

$$P^2=\frac{16^2+12\frac{2}{3}^2}{12}=34\frac{2}{3} \text{ (in feet).}$$

The area would be

$A=16^2-12\frac{2}{3}^2=96$ square feet.

The load for each additional foot under belfry would be then:

$96.150=14400$ lbs., or 7,2 tons.

The whole load from top down for each additional foot would be, in tons:

$w_1=126+(L-26).7,2=7,2.L-61$

While the safe load from Formula (60) would be:

$$W=\frac{96.100}{14+0,046.\frac{L^2}{34\frac{2}{3}}}$$

Now trying this for a point 50 feet below spire, we should have the actual load:

$w_1=7,2.50-61=299$ tons.

and the safe load:

$$W=\frac{96.100}{14+0,046.\frac{50.50}{34\frac{2}{3}}}=554 \text{ tons, or, we can go still}$$

lower with the 20″ work. For 70 feet below spire, we should have actual load:

$w_1=7,2.70-61=443$ tons,

while the safe load:

$$W=\frac{96.100}{14\times 0,046.\frac{70.70}{34\frac{2}{3}}}=468 \text{ tons, or, 70 feet would be}$$

about the limit of the 20″ work.

If we now thicken the walls to 24″, we should have

$a=112$ square feet.

p^2 from Section 4, Table I, $=33\frac{1}{3}$ (in feet).

The weight per foot would be $112.150=16800$ lbs. (or 8,4 tons) additional for every foot in height of 24″ work.

Therefore the actual load would be,

$443+(L-70).8,4$ or

$w_1=L.8,4-145.$

Now, for $L=80$ feet, we should have the actual load:

$w_1=527$ tons, while the safe load would be:

$$W_1=\frac{112.100}{14+0,046.\frac{80.80}{33\frac{1}{3}}}=491 \text{ tons.}$$

This, though a little less than the actual load, might be passed. Rubble stone work, however, should not be built to such height, good brickwork in cement would be better, as it can be built lighter; for $\left(\frac{c}{f}\right)=200$, would give larger results, and brickwork weighs less, besides; then, too, we have the additional advantage of saving considerable weight on the foundations.

Thickening the walls of a tower or chimney on the inside does not strengthen them nearly so much as the same material applied to the outside would, either by offsetting the wall outside, or by building piers and buttresses.

It is mainly for this reason, and also to keep the flue uniform, that chimneys have their outside dimensions increased towards the bottom.

Example.

Circular chimneys. *A circular brick chimney is to be built 150 feet high; the flue entering about 6 feet from the base; the horse-power of boilers is 1980 HP. What size should the chimney be.*

The formula for size of flue is:

$$A=\frac{0,3.HP+10}{\sqrt{L}} \qquad (61)$$

Where $A=$ the area of flue, in square feet.

Where $L=$ the length of vertical flue in feet.

Where $HP=$ the total horse-power of boilers.

A circular flue will always give a better draught than any other form, and the nearer the flue is to the circle the better will its shape be.

In our case the flue is circular, so that we will have

$A=\frac{22}{7}.R^2$ (see Table I, Sec. No. 7) or

$$R=\sqrt{\frac{7.A}{22}}$$

Inserting the value of A from formula (61) we have:

$$R=\sqrt{\frac{7}{22}.\frac{0,3.1980+10}{\sqrt{144}}}=\sqrt{\frac{7}{22}.50,3}=4$$

or the radius of flue will be 4 feet (diameter 8 feet).

Now making the walls at top of chimney 8″ thick and adopting the rule of an outside batter of about $\frac{1}{4}''$ to the foot, or say 4″ every 15 feet, we get a section as shown in Figure 87.

Let us examine the strength of the chimney at the five levels A, B, C, D and E.

The thickness of the base of each part is marked on the right-hand section, and the average thickness of the section of the part on the left-hand side.

Take the part above A; the average area is $(\frac{22}{7}.5^2$ — flue area) or, $78-50=28$ square feet.

This multiplied by the height of the part and the weight of one cubic foot of brickwork (112 lbs.) gives the weight of the whole, or actual load.

$w_1=28.30.112=94080$ lbs., or 47 tons.

The area of the base at A would be:

$$A=\left(\frac{22}{7}.5\frac{1}{3}^2 - \text{flue area}\right);\ A=89-50=39 \text{ square feet.}$$

The height of the part is $L-30$.

The square of the radius of gyration, in feet, is:

$$p^2=\frac{5\frac{1}{3}^2+4^2}{4}=11,11$$

Inserting these values in Formula (60) the safe load at A would be:

$$W=\frac{39.200}{14+0,046.\frac{30.30}{11,11}}$$

$=440$ tons, or about nine times the actual load. Now, in examining the joint B we must remember to take the whole load of brickwork to the top as well as whole length L to top (or 60 feet).

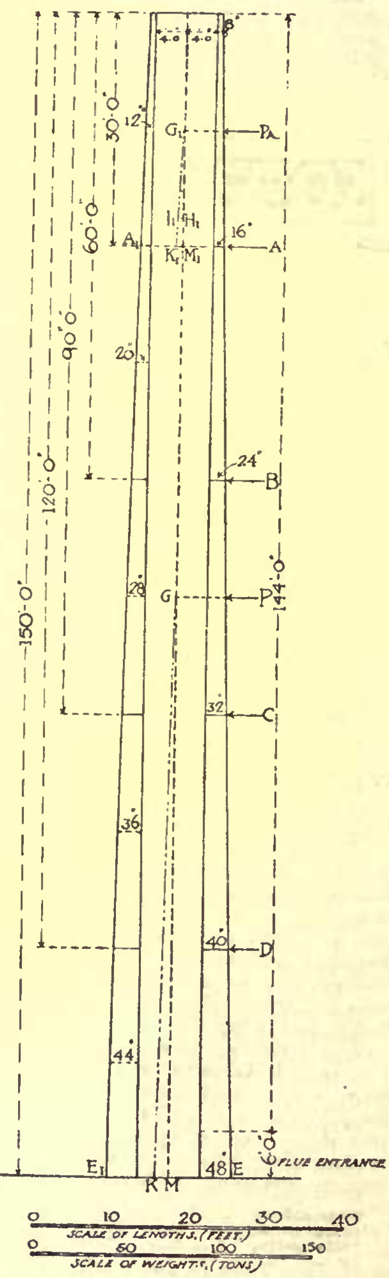


Fig. 87.

The load on B we find is:

$w_1=131$ tons, while the safe load is:

$$W=\frac{63.200}{14+0,046.\frac{60.60}{13}}=472 \text{ tons.}$$

Similarly, we should find on C the load:

$w_1=259$ tons, while the safe load is:

$$W=\frac{89.200}{14+0,046.\frac{90.90}{15,11}}=461 \text{ tons.}$$

On D we should find the load:

$w_1=432$ tons, while the safe load is:

$$W=\frac{119.200}{14+0,046.\frac{120.120}{17,44}}=448 \text{ tons.}$$

Below D the wall is considerably over three feet thick, and is solid, therefore we can use $\left(\frac{c}{f}\right)=300$, provided good Portland cement is used and best brick, which should, of course, be the case at the base of such a high chimney. We should have then the load on E:

$w_1 = 657$ tons, while the safe load is:

$$W=\frac{151.300}{14+0{,}046.\frac{150.150}{20}}=690 \text{ tons.}$$

The chimney is, therefore, more than amply safe at all points, the bottom being left too strong to provide for the entrance of flue, which will, of course, weaken it considerably. We might thin the upper parts, but the bricks saved would not amount to very much and the offsets would make very ugly spots, and be bad places for water to lodge. If the chimney had been square it would have been much stronger, though it would have taken considerably more material to build it. LOUIS DECOPPET BERG.

[To be continued.]

COMMUNICATIONS

THE PRACTICAL VALUE OF GROUTING.

NEW YORK, May 10, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In the current number of your valuable paper, Mr. Berg says: "Theoretically, grouting is often condemned, etc., but, *practically*, it makes the best work, and is to be recommended in freezing weather."

In the interest of safe-building construction, of which I claim to have knowledge, I must take an unequivocal exception to the above statement, and maintain that both theoretically and practically grouting is to be condemned, particularly in brickwork masonry, and that no theory is sound that is not based upon good practice and confirmed precedent, and in support of my own opinion and experience I quote the following authorities:

Col. Sedden says: "Grouting is, in reality, only a remedy for bad work, but as it is next to impossible to get the joints filled in solid mortar, and the bricks properly wetted in dry weather, it is often advisable to make use of it."

"Vicat's experiments show," says Mr. Burnell, "that all limes lose two-fifths of their strength if mixed with too much water."

Rivington's "*Notes on Building Construction*" says: "Grouting is deficient in strength, and should not be used where it can be avoided."

Mr. G. R. Burnell, C. E., in his work on "*Limes, Cements and Mortars,*" says: "The system of grouting is more than questionable in its results; the lime suspended in it is nearly destroyed, the extra quantity of water is but an addition to the difficulties of setting opposed to the mortar already in place."

General Gillmore indirectly condemns the practice, by saying, "That with the same material the adhesive property varies with the consistency of the mortar and the quantity of sand which it contains."

In every instance the instructions in the preparation of mortar are to add just enough water to slake the lime to a thick paste.

General Totten's experiments show that slaking by "drowning" (for grouting is practically a "drowned" mortar), or using a large quantity of water in the practice of slaking affords weaker mortars than slaking by sprinkling.

Hon. R. M. Bancroft, C. E., in his work on "*Chimney Construction,*" says: "Grouting possesses little adhesive power as the water evaporates, and should be discountenanced."

Finally, Mr. Trautwine says: "That unless grouting contains a large amount of cement it is probably entirely worthless, since the great quantity of water injures the properties of the lime, and, moreover, its ingredients separate from each other, the sand settling in the interior of thick masses of masonry; indeed, the same may probably be said of any common lime-mortar. In such positions it has been found to be perfectly soft after the lapse of many years."

In my own practice, I never permit grouting, except for stone masonry, and then only with neat-cement that is quick-setting.

In the interest of safe building and sound architecture, I trust you will find space in your columns for the above remarks.

Yours truly, C. POWELL KARR, C. E.

NEW YORK, May 17, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I confess that I am at a loss to know just how to answer Mr. Karr's "unequivocal exception to" my statement. He sets up his "claim to knowledge," "own opinion," etc., against all "good practice and confirmed precedent," which are decidedly in favor of grouting.

I think that when Mr. Karr has had a little more *practical experience* he will agree with the large majority of the best practical engineers, architects and masons, who thoroughly believe in the efficiency of grouting.

I fear Mr. Karr is a not too careful reader, as he quotes me as recommending grouting in freezing weather, whereas I distinctly condemned its use in such weather. Then, too, he does not seem to notice that all his other quotations but prove my statement, viz., that grouting is often condemned theoretically, but that practically it is good. His very first quotation, from Col. H. C. Sedden (who, by the by, is an English engineer of the largest *practical* experience), distinctly upholds my position.

Very truly yours, LOUIS DECOPPET BERG.

OUR GELATINE PRINTS.

CLEVELAND, O., May 23, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — The correspondence in the last number of the *American Architect* has rather interested me, and as people are generally glad of a little sympathy when criticized, I must say that I heartily agree with your remarks with regard to the Detroit Post-office. It is truly a thing most wonderfully made. With regard to Mr. Barnum's remarks, although he is a very good friend of mine, I cannot say that I entirely agree with him regarding the gelatine prints. The Methodist Church at Baltimore, although hardly a thing of our day and generation, is certainly a *tour de force*, and a building which shows on its face that its designer is a man of cultivation. As a whole, I do not think that we can complain of the gelatine prints, although I would prefer to see more foreign and less native work. The home buildings being accessible, and photographs of them easily obtained, while it is rather difficult to get a really good stock of foreign photographs from which to select.

Very respectfully yours, CLARENCE O. AREY.

TEXT-BOOKS.

BALTIMORE, MD., May 12, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I would like to know what book will give me information in regard to strains in construction, sizes of timbers, roof-designing, ironwork, etc.? I desire to make a special study of this branch, but do not know exactly where to begin. A letter direct, or through the *American Architect*, which I see weekly, will greatly oblige,

Yours respectfully, RICHARD JOHNSON.

[KIDDER'S "*Architects' and Builders' Pocket-book*" gives an excellent concise survey of the subject, and any library catalogue will give information as to the innumerable books by the help of which any particular branch may be pursued. — EDS. AMERICAN ARCHITECT.]

A QUESTION OF COMMISSION.

COLUMBIA, S. C., May 14, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I will ask you to advise me, through your next issue, in the case below stated: I agreed to furnish a gentleman plans, specifications and details for two per cent on a building which was to cost about $15,000. The design was accepted, the working-drawings made, and my estimates were $15,660, at which price I would have built the house. The gentleman then concluded that he wanted a cheaper house. I then made a second design, and drew up the specifications, leaving out of contract all ironwork, granite-work, plastering, painting, etc.; when the estimates were opened the contract was let out at $9,000, my figure being high, $12,099. I might here express some regret for the $9,000 man. The owner is to furnish considerable material, etc., himself, and I do not just know what the amount will reach. Kindly inform me on what figure I should reckon my fee.

Please refer me to the most complete schedule of prices of which you know, and you will greatly oblige,

Yours very truly, GEORGE W. WARING.

P. S. I am, of course, entitled to travelling expenses above this fee.

[IT is customary to reckon commission on the actual cost of a building as if constructed entirely of new materials furnished by the builder, without any deduction for what may be furnished by the owner. The common schedule of fees is that published by the American Institute of Architects, a copy of which can probably be obtained by addressing the Secretary of the Institute in New York; or it may be found in Kidder's "*Architects' and Builders' Pocket-book,*" and probably in various other publications of the kind. About the travelling expenses, much depends on the terms of agreement with the owner. The schedule, and common usage, regard travelling expenses as a disbursement which the owner repays, in addition to the fee for professional service, but our correspondent seems to have made a special contract, differing from that sanctioned by custom, and it would have been safer to have thought to mention the point, although we incline to the belief that in the absence of any stipulation whatever in regard to the matter, travelling expenses would be generally considered to be payable in addition to the professional man's fee. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

THE VALUE OF WATER-GAS IN HEATING AND SMELTING OPERATIONS. — In a recent number of *Dingler's Polytechnisches Journal* are given the results of some interesting experiments carried out at Frankfort-on-the-Main with the object of testing the value of water-gas for heating and smelting purposes. It was found that this gas, made in a Wilson generator, and having the following percentage composition: carbonic oxide, 18; hydrogen, 10; nitrogen, 68; carbonic acid, 4; was

serviceable for the heating of boilers, but unfit for smelting purposes. The melting temperature of silver could hardly be reached, the gas having lost its generating temperature, 400° Centigrade, by the transit from the generator to the furnace. By utilizing this temperature and heating the air of combustion, the ordinary smelting operations could be performed; nevertheless, the use of the Wilson generator was discontinued, because the gas was not cheaper than other fuel for boiler heating. Since 1885 the refining-works at Frankfort have used water-gas, furnished by the neighboring gas-works at 6 pfennige per cubic metre, or about 1*s.* 8*d.* per 1,000 cubic feet. It is not stated by what process the gas is manufactured; but in composition it is identical with the Lowe gas. It is still too expensive for all crude purposes, so that it is only used for melting gold, silver, and their alloys, fluxes, and pigments for the decoration of china, and all purely laboratory work. It was compared with the rich illuminating gas obtained from the Frankfort works, and the poorer gas supplied in the city, the burners used being identical. A copper vessel, filled with water, was heated from 15° to 100° Centigrade, under similar conditions. It took 10 cubic metres of water-gas against 4 cubic metres of Frankfort rich gas, and 5 cubic metres of the poorer gas. Equal weights of two kinds of flux for enamelling-colors were melted under identical conditions, in a Perot furnace. The cost of the gas in each operation was 4.60 and 6.50 marks for water-gas, against 19.6 and 26.8 marks for the rich Frankfort gas. Equal quantities of fine silver and copper were melted with the two gases in the same furnace. It required of water-gas 4.30 and 5.70 marks' worth, and of rich illuminating-gas 16.7 and 21.7 marks' worth. By using water-gas, therefore, all boiling, heating, or evaporating operations can be accomplished for half the money, and all melting for about a quarter the money, as compared with illuminating-gas. It will be seen that this is only the result of the difference in the price of the two gases; for from the first experiment it follows that the pyrometric value of the coal-gas is 2.5 times as high as that of the water-gas.

A Collection of Locks and Keys.—M. Spitzer, an Austrian born in Vienna, but a citizen of Paris, has a mansion in the Rue Villejust containing a most notable collection of masterpieces in works of art. A visitor describes wonderful ironwork found in one of the spacious apartments as follows: "Here are locks and keys of wrought-iron, chased, damascened, and otherwise worked as if the material were as soft as ivory. One wrought-iron lock represents Adam and Eve standing on each side of the Tree of Knowledge, around whose trunk is wound the serpent. The figures are in high relief; the tree with its branches stands out in the round from the tracery background of the lock, and seek as they will the modern smiths cannot discover the secret of its fabrication. Another iron lock has three compartments in the form of a triptych, and on a background of Gothic openwork tracery are figures in high relief and almost in the round. In the middle compartment at the top is God, and at each side an angel; below is Christ and the Virgin Mary, and below them are souls climbing up to heaven or being flung down to hell by attendant devils. In the compartment on the left, Peter, carrying his key, and, aided by two debonnaire angels, is letting souls into Paradise, patting the timid on the head encouragingly. In the right-hand compartment we see hell-fire and quaint devils with long tails prodding unhappy souls and pushing them down into the sea of burning brimstone. On this lock there are nearly 40 figures, each about 2 inches high, and most delicately wrought. The lock is about 9 inches high, each of the side compartments 4 inches broad, and the central panel 6 inches broad. The value of such a piece of work as this cannot be estimated." — *Iron Age.*

The American Exhibition.— But there is no doubt that Exhibition, grounds, switch-back railroad, toboggan-slide, and all the other attractions are but side-shows to the great Wild West entertainment. By no possible stretch of ingenuity can this feature be brought within the scope of criticism in *Engineering*. None the less, however, did a crowd of prominent members of the profession, to say nothing of those eminent in almost every other path of art, science, and industry, enthusiastically follow the prolonged performance that for the first time was given to a British audience a few weeks ago. The grand stand which dominates the arena is large enough to hold nearly 20,000 persons, and of itself is a wonderful spectacle when crowded on every tier and from end to end of its vast sweep. We believe that the Exhibition is practically an American enterprise — we mean that most of the heavy capital required has been furnished from the United States — and we trust that those most deeply interested in the welfare of the undertaking will not be wanting in firm and judicious management — a condition as important as an attractive show. There is little doubt, we think, that if the Exhibition is a success, it will tend largely to increase pleasant and familiar relations between this country and America, while if it should not succeed an opposite result will unfortunately be effected. The public are certainly ready to do their part to bring about the former and much-to-be-wished-for conclusion; it depends, therefore, almost wholly upon the executive.—*Engineering.*

One view of the Natural-gas Question. — A nervous correspondent sends this advice to the Cincinnati *Commercial Gazette:* "From the beginning of the natural-gas 'craze' I have been opposed to it. I believe the boring of gas-wells and the tapping of the gas will result in explosions and destruction of the surface of the earth in the vicinity of said wells. The interior of the earth, I believe, is hollow, and the hollow is filled with a gaseous substance very likely wholly composed of natural-gas. Earthquakes are probably caused by vacuums made by the flowing therefrom of the gas. Now, the interior of the earth being filled with said gas, it discharges the same purpose that the gas does to a balloon. While filled with gas the balloon floats in space. When extracted or consumed it collapses or falls to the ground. So with our earth. Take from it gas enough, as will be done in a few years if this gas craze goes on, and the crust of the earth will become dented and broken as the vacuum increases in size, even should the internal igniting and combustion not take place. Continue the consumption of the gas until the motion of the earth in its orbit is affected and our little earth will lose her place among the heavenly bodies and go crashing to pieces as the balloon falls to the surface when its gas has become expended, or it breaks and lets its gas escape."

The Panama Canal. — A letter from Panama, dated May 11, states that in one of the largest, longest, and deepest cuts, high up above the prospective canal works, water has been struck. The amount of earth and rock taken out of the section referred to has cost millions of dollars. All the work represented by these millions is to-day valueless, as the water has washed from the side of the mountain more than sufficient to fill all the cuts. On the isthmus the purest water is found among the highest strata.

TRADE SURVEYS

Out of the multiplicity of opinions expressed in building, trade and commercial journals concerning the future of trade, two conclusions can be drawn, viz., that a depression is near at hand as a consequence of the extraordinary activity, and that a still greater boom is inevitable in consequence of a permanent expansion in the consumptive capacity of the American people. Pessimists and optimists can be accommodated with ready formulated conclusions from the same raw materials. The facts given and the conditions described favor either one or the other opinion. Wise men will stear clear of expansion of working power, based on debt. The industries are practically debt-clear. Credits in trade are being shortened. Less business is done on credit or promises to pay according to the entire volume than ever before. The volume of business is expanding, while the volume of liabilities of broken concerns is relatively declining. The industries, great and small, are still gaining in strength and activity, but much of their prosperity is intimately connected with the extraordinary railway-building activity. When this limit is reached a reaction must set in. But capitalists who are investing in railway enterprises are strong in the conviction that the present activity will be permanent, that the influx of a million thrifty foreigners per annum and the outflow from the Eastern States will necessitate continued activity. Winter mill-work began pouring in last week. Rails, bridge-iron, plates, and pipes were called for in large quantities. New roads calling for the construction of fifteen hundred miles of road have been projected within two weeks. While English investors exhibit a little customary caution in buying American railway bonds, they are willing to send large blocks of capital for careful investment. Money is abundant; the abstractions of the enormous treasury surplus does not visibly affect the country. The extraordinary absorption of money in reproductive channels does not seem to create a scarcity, nor does the exceptional production in progress show the slightest evidences of an accumulation of stocks or merchandise at forge, shop, factory, mill or mine. These half-dozen or more facts are the factors which the captains in the industries and in finance and trade are now using to solve the, to them, extremely important problem of the probable course of trade and industry for the next year or two. High financial authorities have figured out that investments are now contemplated involving upwards of one hundred million of dollars in railroad, manufacturing, engineering, building, and other enterprises, besides other large investments, in the aggregate, of small operators, whose movements cannot be seen or estimated upon. The debate now is on the point of pushing ahead or waiting. Another point considered is, will more money be made by legitimate investments, or by buying up the wrecks of failure. A moderate panic could and would transfer the title to a thousand or two million dollars' worth of property in a year or two. Will capital add to the mountain of investments, or will it wait for the storm? Have values reached their limit? Are still higher prices probable? Has real estate seen its best? Is the building boom nearing its legitimate limits? Will governmental policies regarding finance weaken or strengthen public confidence in the wisdom and safety of expanding operations? All these and many more questions are passing before the minds of our leading men in railroad management and in manufacturing and commercial channels. The fact that is evident to the layman in such matters is, that the country is entering upon and into new conditions where old rules and measurements do not answer. Another is, that capital-share of reproduction will hereafter be less, that money, in short, will be cheaper, and facilities of every wealth-producing character more abundant. Hence the possibility of an industrial depression is more remote. The housing of the millions will engage more capital.

The movement of a company in a Western city with a capital of five million dollars to build houses for working men is only the first step in a new reform that will ere long be taken in many cities. All past agitations and progress has been in the direction of this one result. Strike agitations fail in Philadelphia because upwards of one hundred thousand houses are owned by laborers. Chicago agitations may be made impossible by similar action. There is every reason why a workman should endeavor to acquire his own home, and the movement has already set in, of modest proportions at present, it is true.

When such a result as this is reached all such questions as are presented in the early portion of this review are set aside. The establishment of new industrial conditions and surroundings will engage the attention of the practical minds of the next decade or two. To-day the industries are in excellent shape even though one hundred thousand men are idle. The examples are not contagious. Labor is more anxious to work than strike. The growth of employers' organization is apparent in nearly every State. The double object will be served, that of protection against labor assaults and against overproduction. The overproduction evil will never be as serious a factor as it has been. Production is now under control. The wisdom of suspension is recognized by producers to the prevention of bankruptcy. Any other restriction has been found difficult and impossible in fact. In manufacturing circles there is a conservative feeling. Summer and autumn orders have been liberally placed by buyers. Jobbers are hopeful. Iron, except in merchant bars, is active. Lumber is in abundant supply. Crop reports are full of promises. Cotton is firm and wool is steady. The distribution of the staple products of New England is satisfactory. The industries of the Middle States are crowded with orders. The Western States are free from the evils of scarce and dear money, and overbearing management of railroad companies. Tens of thousands are building up homes in the far Northwest, and the staples of life are becoming cheaper. The builders, except in Chicago, have a season's contracts on hand, and the season's prospects, both West and South are brighter than at any time.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, by TICKNOR & COMPANY, Boston, Mass. No. 598.

JUNE 11, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

A GOOD deal is said just now in the daily papers about the revival of a scheme which was proposed nearly twenty years ago, for the erection of a Protestant cathedral in New York. When the plan was first talked about, St. Patrick's Cathedral on Fifth Avenue, between Fiftieth and Fifty-first Streets, was in process of construction, and gave promise of being a very beautiful building; and the interest which this excited naturally gave rise to a feeling that the Episcopalians, as the leaders of the Protestants of the city, ought to be represented by a church comparing in size and interest with that of the Catholics. Many meetings were held privately to discuss the matter, and, if we are not mistaken, the late Mr. Richardson was often invited to participate in them, but in the disastrous years which followed it was useless to try to collect money enough for a suitable building, and nothing was done except to form a corporation and procure a charter, authorizing the trustees of the corporation to hold and improve real estate. The trustees, as is rather apt to be the case, did not feel it incumbent on them to do more than manage the funds that might be put into their hands through the exertions of others, and as the rest of the world expected the trustees to make all the exertions, the matter might have been totally forgotten if it had not been for a lady, Miss Catherine Wolfe, who kept in mind, among her many plans for doing good, a project for helping the cathedral scheme if it should ever be revived. Her first idea was to bequeath a million dollars to the corporation in her will, but a year or two ago, when there appeared to be symptoms of returning interest in the affair, she concluded that it would be more useful to contribute the money at once, adding, if necessary, further donations on occasion, and her will was accordingly changed. To help her in her kind plans, she sent for a trusted adviser, Dr. Nevin, of Rome, in order to have the advantage of his judicious suggestions in regard to the conditions which should accompany the gift of so great a sum, but he arrived in New York only to find her very ill and already unconscious, and she died soon afterward.

ALTHOUGH Miss Wolfe's part in the undertaking was thus brought to an end, the knowledge of what she had intended to do served to attract attention to it, and the trustees took advantage of Dr. Nevin's presence in the city to enlist his services for a time in preparing the details of the scheme. As soon as this is done, public attention will be earnestly called to it, and contributions asked for. Already about half a million dollars has been promised, and it is thought that six millions, which will complete the building sufficiently, at least, for occupancy, can be easily raised. It seems to be the general feeling in New York that such a building will represent in a certain way all the Protestant denominations. A rich Presbyterian has given a hundred thousand dollars toward it, and if the movement can be kept out of the hands of a few fanatics in the Episcopal church, it is not unlikely, we imagine, to meet with a success which will surprise its promoters. Unless the indications of the times are very erroneously reported by those who study them, there is to be observed at present among the Protestant sects the beginning of a common sympathy which will naturally seek occasional opportunities of expressing itself. Under wise management, a great church-building, open at least to all Protestants, in which should be cherished, as in St. Paul's or Westminster Abbey, the memories of those Americans who have set conspicuous examples of a conscientious life according to the precepts of the Christian Master, might become, we fancy, the object of an almost passionate enthusiasm among a people so sympathetic, we could almost say romantic, as the Americans are at heart. If a Westminster Abbey for this country is to be founded, the Episcopalians, as the representatives of our oldest Protestant associations, are certainly the ones to do it, and to conduct it afterward, and New York is probably the only place where the Episcopal element is powerful enough to carry it out. We need hardly say to architects that six million dollars will not build anything comparable with a large foreign church. St. Patrick's, with its lath-and-plaster vaulting and stucco imitations of carved stone, is said to have cost three millions without the land, which is worth now nearly three millions more, and the cost of Mr. Richardson's beautiful design for the Albany Cathedral, which, although real and solid in construction, was hardly more than a large parish church, is said to have been estimated at five millions; so that at least twenty millions ought to be spent to secure a site and a building worthy of the principal city of America. That this could in time be raised we have no doubt. Even if it took six hundred years to get it, as at Cologne, the end would come in time, and a building planned and begun on such a scale, with some such instructions to the designer as the sole direction given to the architect of the cathedral of Florence, that the new church must be the most beautiful in the whole world, and the most worthy of the city of Florence, would, from the first, be a pride and pleasure to the entire country, and would grow constantly richer in associations until its completion, perhaps centuries hence.

WHATEVER is done about the cathedral, we hope that an effort will be made to have it architecturally respectable. It may be taken as certain that even a small building, if treated as a mediæval community would have treated it, with the highest skill in design and decoration that the community or the country can furnish, may easily be made the greatest artistic treasure of New York, winning for itself substantial evidence of affection and care for centuries; while a huge and tawdry pile, carried out by a succession of sharp contracts, and bearing on its face indications that its design was secured as a sort of architectural "job lot," will, if it does not previously fall down, be swept away as soon as age has increased its ugliness past endurance. It is folly to say, as so many do, that only one person in a thousand can tell good architecture from bad, and that it is, therefore, useless to spend money on imperceptible points of design. Although perhaps the proportion of those who understand architectural art is to those who do not about as one to a thousand, it must be remembered that in the end the judgment of the one educated person always prevails. There is nothing more interesting in the annals of art than Sir Joshua Reynolds's description of his visit to Italy, to see the works of the great Italian masters. At first, in his provincial conceit, he was disposed to think that Raphael and Titian had been overrated by successive generations of uninstructed amateurs, and that his superior training and perceptions would enable him to find many defects in them. For a time, even after he arrived in Italy, he held to this view, and compared and criticised them with that indulgent superiority which we have probably all experienced. As his observations extended, he began to notice things about Raphael's pictures which had previously escaped him, and which disturbed his theories. Further study still more unsettled his opinions, and he began to think that there was much to learn from Raphael, notwithstanding the general advantages of the scientific modern system; and a few

days later he had abandoned the modern system altogether, to try humbly to study the sources of the ineffable superiority of the great Italians over all their rivals, ancient and modern. The conclusion which he drew from his experience, and sought to impress upon his pupils, was that the public opinion of pictures, formed slowly enough to escape the influence of passing fashions, was always right. An artist, trained in this or that school, would generally look with prejudiced eyes upon the works of his contemporaries, and perhaps for a time on those of the ancient masters; but the sure way of getting rid of these prejudices, and escaping into the clear atmosphere in which alone great work can be done, was to study the pictures which have been for centuries regarded by common consent as the masterpieces of the world. So with the great art of architecture: the smart, the astonishing, the cheap, may all secure a noisy contemporaneous applause; but the work which is to endure — to touch men's hearts more and more for ages — can only be produced by the long and patient effort of men gifted as only a few are in a generation. Even they can only go slowly through the difficult task of expressing themselves in stone, and they must have time to do it. We bemoan ourselves copiously in this country, because we possess no Donatello, or no Ghiberti, to set at work on our architecture; but we forget that the Florentines kept Ghiberti employed forty years making two doors, and were, with reason, contented with the result. In this country a building-committee, after the famous competition, would have waited on the goldsmith's son, and, after various disparaging remarks about his talents, with suggestions as to the trivial character of the work to be done, and hints of the exceedingly cheap rate at which a rival sculptor had offered to undertake the job, would suddenly ask him to set the lowest figure, and the shortest time, which he would agree to in case they gave him the commission. Having tied him to a contract on these points, they would harass him until he had struggled through his task somehow, when they would probably deprive him of his pay on some pretext, and leave him despairing. It may be imagined whether the "Gates of Paradise" would have been the result of such transactions; and yet it is not too much to say that half the monumental buildings in America have been designed under similar conditions. We will not cite examples; every architect can supply plenty of them; but it ought not to be necessary to point out that no great work is ever likely to be done under such a system, and this through no fault of the American artists or architects, all of whom, who are good for anything, will do twice as much work as they are paid for, if necessary, out of pure love of art. Comparisons are well known to be odious, so we will not make any; but to our mind Mr. St. Gaudens, or Mr. Warner, with Mr. LaFarge, for instance, acting in concert with any one of several architects we might name, if employed, like Ghiberti and Brunelleschi, to spend the rest of their lives upon a single building, could make of even a small structure the most beautiful and interesting piece of architecture in the world. We say this without any disrespect to the Greek and Gothic architects, whose superiority we cheerfully acknowledge, but whose works, robbed of their sculptures and their color, barely serve to enable us to guess at what might have been their intended effect. There is, perhaps, no class of our artists better equipped than the architects to dispute the palm of superiority with the rest of the world. Hitherto they have rarely had a fair chance to show what they could do, if allowed time for their laborious work, and we should be very glad if the building of the New York Cathedral, which must in any case be a leisurely operation, should be so managed as to secure, in a manner really adequate, the coöperation of all that is best in American art.

A CURIOUS suggestion has been made by a very distinguished archæologist, M. Alexandre Bertrand, in a lecture upon French archæology, delivered recently at the Louvre. In speaking of the ancient Gauls, before the time of Cæsar, he mentioned their fortified camps, or "*oppida*," which the Romans afterwards found so formidable, describing minutely their construction. They were, in substance, fortresses of logs, interlaced, and spiked together, and filled in subsequently with earth and stone. The timber skeleton rendered the rampart proof against the blows of the battering-rams, by which the Romans were accustomed to beat down without difficulty heavy walls of masonry; and the earth filling prevented the enemy from attacking the work with fire, which was the common weapon against all wooden structures. The most interesting feature of the construction, in some respects, was, however, to be found in the spikes, or nails, by which the timbers were fastened together. These were of a very pure wrought-iron, square in section, and were in some mysterious way protected, so that to this day, after having been buried in the earth for twenty-four hundred years, they show in most cases little or no sign of rust. Singularly enough, all the spikes which have been found in the ruins of the *oppida*, of which a large number are known, are of the same form and character, as if they had all come from the same workshops, while the iron of which they are made differs materially from the metal of other objects of the same period, as, for instance, the swords of the chieftains, which are often found in their graves, almost entirely converted into rust. M. Cailletet, the well-known chemist, analyzed, two or three years ago, the metal of some of these spikes, which were found, with some traces of decayed wood, in the mound which marked the site of the ancient fortress of Vertault. He discovered, or thought he discovered, a coating of magnetic oxide of iron over them, and, recalling the Barff process, by which objects of iron are covered with a protecting film of magnetic oxide by exposure to superheated steam, he inferred that the Vertault spikes might have accidentally received a similar coating through the burning of the woodwork in which they were buried.

UNFORTUNATELY for this theory, there is no indication, nor any probability, that the woodwork of the camp of Vertault ever suffered from fire, and even if it had, this would not account for the similar resistance to rust of the nails found in a score or so of other ruins. M. Bertrand, in consequence of the difficulty in explaining the matter as the result of an accident, inclines to the belief that the production of an unchangeable coating was a workshop secret, known only to the proprietors of a certain rustic forge, who carried it with them to their graves. So many trade secrets have perished in a similar way that this theory does not seem unreasonable; and the fact that nails of a certain manufacture were used, even in that primitive age, all over a large territory, need not surprise those who reflect that long before iron was known in Europe a considerable commerce in bronze articles was carried on between Germany and Italy; but General de Villenoisy, who writes on the subject to *La Semaine des Constructeurs*, observes that it is not only unlikely that so important a secret as this should have been allowed to die out by the makers of military articles in the third century B. C., just as the Gauls were gathering their forces for their long struggle with the Romans, but that there is positive proof that if there were any such secret it had not perished ages afterward. Certain embankments, as he says, which were constructed a few hundred years ago on two small rivers near Grenoble, were sustained by piles, which were fastened together with spikes. These spikes, when examined not long ago, were found absolutely free from rust, although they had been for centuries exposed to conditions under which modern iron would have been speedily destroyed. Like the Gallic nails, these spikes were covered with a thin film, possibly of carbonate of iron. It is altogether probable that the metal of which they were made came from the forges of Allevard, a town in the neighborhood which still produces large quantities of iron-ore; and it is remarkable that the metal-work of the old forts of Briançon, which was probably made at the same forges at the time of the construction of the forts, a hundred and forty years ago, has remained to this day without the slightest trace of rust, although in a very exposed situation. A film covers this iron-work, similar to that upon the spikes which fastened the piles in the river; but the General believes that in both cases its production was due to accident, rather than intention. The Allevard iron is extremely pure, and in the last century was worked altogether with wood fuel, but beyond this it is impossible to say in what manner the process of smelting and forging it, or of treating it subsequently, differed from the process now in use. The only thing certain about the subject is that, either by accident or design, small, common articles of wrought-iron have for ages been produced by simple means which were proof against rust. In this age of applied chemistry and metallurgical science it ought to be possible to do anything with iron that a fur-clad, shaggy-headed Gaul could do, and a student of such subjects could hardly render the world, as well as himself, a greater service than to investigate the matter thoroughly. If, as M. Cailletet thought, the protecting film was composed of magnetic oxide, it is plain that the ancients had some way of producing this film by simple means, and it must be possible to imitate their processes.

THE GROWTH OF ECCLESIASTICAL DECORATIVE ART IN AMERICA.



The CHASE of MELEAGER — Portion of BAS-RELIEF by RUDE, CHATEAU DE TERVUEREN.

THERE has been much self-congratulatory talk in recent years with regard to the development of artistic feeling in our country. Facts of wide and curious variety have been cited to prove how great has been our growth both in productive power and in appreciative power — how many more paths are open to the artist than were open twenty years ago, and how many more artists are capable of treading them to success. And we have sometimes shown ourselves possessed of at least one artistic gift — ingenuity — by the way we have twisted discouraging facts into bases for encouraging arguments, and have seen in failures the signals of future sure successes.

And yet with all this keenness to perceive happy indications and willingness to make the best even of unhappy ones, there is one sign of advance which has scarcely received any recognition in speech or print — one which is very clear, and, it seems to me, almost more pregnant with possibilities of future great achievement than any other. This sign I find in the steady and rapid way in which we are growing once again to demand the service of art in our churches.

We may be enthusiastic Churchmen, orthodox descendants of Puritan sires, indifferentists, agnostics, Buddhists or what not; but whatever we are from a religious point of view, all of us who care for art must rejoice for its sake to think that it is again being given a foothold in the various temples of our very various faiths. It would be difficult to count up the hindrances and hurts which must always result to art when it is forbidden to adorn the exterior of the church or to enter within its doors. Perhaps in some coming age our municipal buildings will be as open to "high art" as were once those of Italy and of Holland, and as are now those of France. Perhaps even our railroad stations may offer their vast wall-spaces to the artist instead of covering them, if at all, with stencilled patterns or — as has been done in Philadelphia — with a vast colored map of our country. It has seemed to me that even this map is a hopeful sign, and that the enlivenment it gives to its wall and the interest it excites in the passing throng may help the advent of much better things.

But however hospitable our secular walls may become, there are certain artistic ideas, certain kinds of sentiment proper for artistic expression, which can never find an appropriate place upon them. And these excluded ideas and sentiments are, if not the most forcible and frequent at all events the deepest and purest, the most lovely and most spiritual to which the human mind can give birth. Only in structures devoted to religious services, to hours of mental repose, of spiritual refreshment and aspiration, and of tender retrospective thought are monumental decorations in place which express the finest and subtilest emotions of our nature. And only there, moreover, can the artist often appropriately reproduce the scenes of Bible history — at least upon any monumental scale; and whether or no he be "religious," whether or no he be spiritual, whether or no he believe in the accepted symbolism of those scenes, almost every artist is led at times to desire to turn to them for pictorial inspirations — to draw upon that vast and splendid magazine of historic facts and ideal conceptions which is all the more tempting to the true, as contrasted with the mere literary or story-telling, painter by reason of the very familiarity of the public with its materials. In almost every exhibition-room we see signs of the impulse to express reverential sentiment and of the impulse to paint Biblical subjects; but neither impulse can be fully gratified or can express itself in the completest and noblest way until our church-walls shall be freely offered to the brush — until a religious picture, or a picture with a Biblical theme, can be conceived upon the noblest scale, and with the consciousness that some definite and fitting place is waiting to receive it.

And as with the painter so too with the sculptor, and to an even greater degree. Cabinet art, art for the adornment of private homes, offers far greater opportunities to the brush than to the chisel, and far better compensates the painter than the sculptor for the modern dearth of monumental opportunities. *Scale* is of more importance to the sculptor than to the painter, though it is by no means unimportant to the latter; and *actualité* offers him a field which is by no means so nearly sufficient to his needs and his desires. If we should exclude all works of a religious character and all works destined to be placed in churches from the bequests of Renaissance painting, the loss would be immense. But if we should exclude all such works from the bequests of Renaissance sculpture, very little would remain. Of course the conditions of things have changed and certain secular opportunities are greater to-day than they ever were before. Even in Renaissance days there were no soldiers' monuments in every village, and beneficent private citizens were rarely commemorated in street or market-place! But though such opportunities as these are frequent with us, their range is narrow and they offer the sculptor small outlet for certain sides of his nature and small opportunity for certain processes of his art. A monument may honorably commemorate the dead wherever it be placed, but how can it be given any touch of tender sentiment, of loving reverence, of ideal charm, if it is to stand under the open sky amid cabs and drays and horse-cars? And how even if it is to stand under cover but in some great, busy, indifferent, civic or commercial rooms? There was nothing which, when I was in England, I coveted more for our sculptors than a chance to do monumental work, such as is afforded the English sculptor by the newly-revived practice of setting up tombs and statues and memorial tablets in the cathedrals, and the parish churches of the land. Here indeed is a full opportunity to do anything whatsoever from the most ambitious to the most simple and modest kind of work — from an animated standing figure to a great ornate tomb with a life-size recumbent effigy or a little tablet with an inconspicuous medallion; to be either realistic or idealistic; and to work either in the round or in any species of relief. It is a priceless opportunity — and one which if it were ours, I think, we should soon learn to use more successfully than it is used in the England of to-day. Anything quite like it we can never hope to have, but still we might have something remotely akin to it in possibilities did our people recognize all their duty to themselves, to their religion, to their dead, and to American art. It is only the last-named duty I have dwelt upon, but the others are just as imperative. Not only art but the Church would vastly be the gainer were our old Puritanical, art-hating or art-despising ideas wholly given up when the ornamenting of the exterior and the adornment of the interior of our churches is in question.

But it is indisputable that to a certain extent they *have* been overcome. To a certain extent we have already thrown off the bitter and dwarfing inheritance of Puritanism as regards ecclesiastic art. The difference between the church of to-day and the church of twenty years ago is extremely great both within and without; and, I repeat, the fact seems to me of the very happiest augury. No one would now dream of questioning that to build the church the architect in his highest potency is required; and year by year we show a growing wish that the painter and the sculptor, each in *his* highest potency, shall be called in to supplement and complete the architect's labors. Trinity Church in Boston was the first in the country whose interior as a whole was confided to an able painter; and the fact that it was and that an immense impulse was thus given to the growth of ecclesiastic decoration is not the least of the many debts we owe Mr. Richardson. From the very beginning of his career he recognized the claim of the sister arts to supplement his own, and felt the immense benefit which his own would receive from their co-operation — felt, indeed, that it could never do its best without their help. The interior of Trinity, the tower of the Brattle-Street Church, and the vast and richly-sculptured porch which he designed for Trinity also — these are but the most conspicuous results of his constant and earnest effort to advance the status of monumental painting and sculpture, as well as of monumental building.

And the other proofs of our progress in this direction are too many and varied even to be summarized here. It is not long since we first showed a wish for artistic figured glass, for instance; and yet our artists in this branch have already set themselves at the head of the world, and the demand for their services grows daily greater. Already it is not exceptional but usual to color the whole of a church interior, if not with painting properly so called, at least with pleasant and harmonious tintings. Already the sculptor, the iron-worker, the bronze-founder and the wood-carver are called upon to give of their best work for the church's accessory features. And even true painting and sculpture of the highest class find from time to time admittance even within Protestant sanctuaries. In the Church of the Incarnation alone, for instance, New Yorkers may now see two large and beautiful pictures by Mr. LaFarge set in the chancel wall, and enframed in an elaborate architectural setting; a mural monument designed by Mr. Richardson in his earlier years; one or two other monuments which, if not quite successful, prove good intentions; some excellent stained-glass by Mr. LaFarge; a beautiful font with a bronze figure of the infant Baptist, by Mr. Louis St. Gaudens, and a pulpit of carved wood which is a true work of art in its way. The Brick Church on the corner of 37th Street and Fifth Avenue, where Dr. Spring preached in my childish days to a Puritanically-minded congregation between walls of Puritanical blankness and whiteness was turned over to Mr. LaFarge for decoration two or three years ago; and the hopeless meagreness of its architectural forms is now relieved and half-redeemed by a lovely all-covering shroud of color. I know of no more striking proof of the progress of new ideas than the decoration of this church, yet it affords, too, a very curious proof of how old ideas still survive to leaven and cramp the new. Mr. LaFarge was not allowed to introduce figures into his decoration when he worked either with the brush or with mosaics. Yet figures are conspicuously used in some of the windows, and a bust of Dr. Spring stands in front of the organ gallery! Cromwell's people called even the purely decorative figures in the old churches "idols." Modern Puritans seem still to have a lingering idea that they are something of the kind — but why

more upon the wall than upon the window, and why more a figure of a St. Paul or a St. Augustine than of a Dr. Spring?

The Episcopal congregation which worships in the Church of the Ascension is more consistent in its new-born love of art. It has recently commissioned Mr. LaFarge to paint it a great picture, symbolic of the church's name, which will fill the whole upper part of the broad chancel end, and which when it is complete will undoubtedly be the greatest work of ecclesiastic art we shall have toboast of.

And the Unitarian congregation which worships in Dr. Bellows's former church on Fourth Avenue — the interesting Byzantine structure built by the late Mr. Mould — has also recently proved its desire to possess a work of true art. When a memorial to its former pastor, Dr. Bellows, was proposed, it was felt that a mere inscribed tablet would be insufficient, and Mr. St. Gaudens was commissioned to design and execute something that would do all that American art *could* do to honor one who was not only a great preacher, but a public-spirited and most happily influential citizen. In this monument, unveiled some months ago, we have, I think, the finest ecclesiastic work that one of our sculptors has yet produced, and a work which may, without fear, stand comparison with the best in any other land or of any age.

It is very hard to praise a work of art whose greatest virtue is simplicity, and even the illustration elsewhere given will not wholly help out my words. Scale, as I have said, goes for very much in a production of this kind, and the texture of the material, too; and, moreover, the marble tablet, bearing an inscription [1] upon its lower portion, against which the bronze relief stands is omitted in the print. Of course an unusually good chance — as things go to-day — was afforded by the clerical gown, but it is the most hackneyed kind of a truism to say that only a good artist can use a good chance to produce success. A Geneva gown might prove as intractable in certain hands, as, for instance, the cloak which Mr. Lincoln wears on Union Square. The way in which Mr. St. Gaudens has treated it seems to me not the least remarkable point about his result. Its lines are most admirably disposed — neither so few and simple as to seem to produce an effect of baldness or commonplace, nor so many and broken as to fritter away breadth or lose repose. And with a quite marvellous skill the "realistic" tendencies of modern art have been so respected that the kind and quality of the material is expressed, and yet its sculpturesque dignity as drapery is not impaired. There is no Bernini-like or contemporary-Italian-like effort to display technical skill by making one exclaim first of all, How exactly the silk has been reproduced! And yet it very evidently *is* silk, and could not be supposed to be anything else. It is almost the abstract drapery of "ideal" art, and yet it is not abstract but very definitely and distinctly individualized. Nor should it be supposed that such a fact as this is unimportant. No fact can be unimportant which helps to make up a true success in art. A tyro in observation might not guess how much less dignified, noble, pure and ideal the figure would appear were the silkiness of its garments more brutally emphasized, or how much less real, life-like and genuine it would appear were this wholly unmarked. But a little of that criticism which means the contrasting of truly good things with pretty good ones and bad ones would soon convince him how largely the well-balanced treatment of this drapery adds to the truth and beauty cf the general result.

It is more difficult to appreciate the skill displayed in the whole relief technically considered as such. I fancy no one but a sculptor can quite appreciate it, for simple though the processes of the art appear to ignorant eyes, they are never really simple or "natural" but always subtily conventional, and never more so than in low-relief. The more we study this process in the products of that age which developed it most completely — the Italian Renaissance — the more we marvel at the delicate skill they display, and the less we seem to understand the rules which guided it. And the more we have compared modern products in this branch with Renaissance products, the more we must admire the exceptional degree of mastery Mr. St. Gaudens has obtained over its exceptional difficulties. Fine and beautiful as are his works in the round, his works in relief seem to me still more remarkable and still more individual. Nowhere else is so fully shown his power over linear beauty, the charm, the supreme distinction, the grace combined with strength, the refinement and the purity of his manner. Such a relief as this Dr. Bellows or as the group of two children with their dog which was shown last summer at the Metropolitan Museum, is to be counted not only one of the best in quality among modern works of sculpture, but one of the rarest in kind among those which are very good.

What I have said of the treatment of the drapery in the Bellows figure applies equally well to the effect of the work as a whole. It is realistic, and yet it is ideal. It impresses us first of all as a complete and beautiful work of art — one which would excite interest and command admiration, even though we knew not whom it represented. And this is to say that although it is a faithful, simple, and thoroughly modern-seeming piece of portraiture, it is a spiritualized, ennobled, idealistic portrait too. It is the man as he lived, and yet it seems as though it must be something a little finer than the man as he lived. It is himself but not his average self — rather his truest self caught in the purest possible mood. It is all, we feel, that such a man as Dr. Bellows *could* have been — and this of course is what every portrait should be, what very few are, and what none can be that is baldly "realistic" and nothing more. I am speaking without personal memory of Dr. Bellows's features, and therefore without knowledge as to whether or no they have been reproduced with entire exactness. But it really matters very little whether they have or not. What is wanted in a work of this sort — the portrait of a public man which is to preserve his memory green with the public of coming years — is less an accurate reproduction of his nose and chin than a clearly expressed, vital conception of his character and presence, one which will agreeably, faithfully, and effectively supplement and explain to eyes which never saw him the general portrait left in tradition and in print. And this, I am very sure, is what Mr. St. Gaudens has given us — probably a faithful likeness in detail, certainly a faithful, typical, interesting and ennobling conception of the nature of the man.

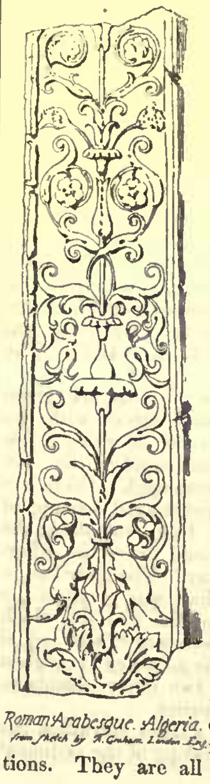
It is comparatively easy to be very faithful in portraiture, and comparatively easy to be idealistic in sculpture. But to be able in a sculptured portrait to keep a firm hold of reality, and yet to infuse it with idealistic grace and charm and nobility, and to do this so simply that the result excites neither surprise nor wonder, only a feeling that it is right and good, and must have been inevitable, that it not only ought not to be, but could not have been anything different — to do this is to prove one's self what I am not in the least afraid to call a great artist.

The figure is rather larger than life, appearing now that it is in place on the wall, but just about life-size. The inscription and the cross upon the bronze refer to Dr. Bellows's valuable public services as President of the Sanitary Commission during the war, and the longer inscription on the marble below bears tribute to his work within his church and to his qualities as a man. In the architectural accessories which add very greatly to the beauty of the result, Mr. St. Gaudens had the assistance of Mr. Stanford White. Nor should the main inscription be passed by without a word of praise. Such things are the very hardest in the world to write, modern habits of speech and pen not lending themselves naturally to that clearness, conciseness, force, dignity and harmonious rythm of expression which monumental writing demands. We seldom see even a passably good modern inscription, but this one is almost as good as though some Elizabethan pen had written it.

How good it is may perhaps best be understood by comparing it with the one which is displayed on the monument to Edgar Allen Poe that was set up not long since in the Metropolitan Museum. And I venture thus to draw attention to the latter work as a comparison of its scheme, and its execution as a whole will very clearly show in how extraordinary a state American art and American patronage are to-day. How the same years could produce and could be content to put on permanent exhibition a work so completely good as the Bellows monument, and a work so phenomenally bad as the Poe monument will seem to our great-grandchildren, I imagine, the most curious sort of riddle. But there is comfort in the thought that it is not very long since such work as that of the Poe Memorial was the best we could get even if we wanted better, while to-day such work as that of the Bellows Memorial excites great admiration truly, but no very great surprise. M. G. van Rensselaer.

[1] A PREACHER, STRONG, FERVENT, UPLIFTING. A COURAGEOUS THINKER, A PERSUASIVE ORATOR. A PATRIOT LOVING FREEDOM, INDIGNANT AT WRONG. A LIFE-LONG PHILANTHROPIST, AN ARDENT, GENEROUS FRIEND. JOYOUS WITH THE JOYFUL, TENDER WITH THE SORROWFUL. A DEVOUT CHRISTIAN, TRUSTING IN GOD AND HOPING ALL THINGS OF MEN.

ARCHITECTURAL DISCOVERIES AT ATHENS.



Roman Arabesque. Algeria.
from sketch by A. Graham London Esq.

THE Archæological Institute of Rome was founded and mainly supported by German energy and German learning, and a succession of German secretaries resident on the Capitoline Hill have superintended its library and the series of publications which, under the Italian titles of "*Monumenti Inediti and Annali,*" have done so much to extend our knowledge of Classical Antiquity. Under the same influence which has changed so many things, this Institute will, in future, be known as the Imperial German Archæological Institute; the series of its publications, however, will continue their course, as well as the *Andhäologische Zeitung;* and in addition there will be a yearly issue at Berlin of an important publication, "*Antike Denkmäler,*" of which the first specimen is now before us. It consists of twelve plates accompanied by a few pages of text touching only on what may chiefly require explanation. The editor is Dr. Max Frëmkel, and in these large and handsome folio-plates he marks a very high standard of execution and evinces an intention to leave no class of ancient monuments without attention and illustration. Our particular interest is concerned with the two plates of the architectural discoveries on the acropolis of Athens; but it would be unfair to pass the others without notice.

One sheet is given to Greek jewelry found at Ithaca and elsewhere; two others to small terra-cotta tablets and fragments of tablets chiefly found near Corinth, mostly perforated for suspension, and several inscribed as dedications. They are all in the antique style of black figures on red

ground; they have considerable interest archæologically, but no true artistic worth. The subjects of a large number refer to the potter's own art: men are digging clay, hauling it in baskets, shaping it, or painting stripes on it when shaped upon a revolving table, tending a kiln, raking the fire, etc. One design shows the section of a kiln in which are seen a number of vases of various forms huddled as close as they can lie with no attempt to indicate how sustained.

We have, then, large-size heliographs of the two bronze statues recently drawn from their hiding-places, which have kept them safely for centuries, at Rome. The seated pugilist is particularly expressive. There is a coarseness and vulgarity in the forms and attitude of the figure which involuntarily prompt a description of his appearance in the terms of that literature which, some forty years ago, used to record weekly the incidents of the P. R. (prize ring) in metaphors dear to its patrons who loved to be known as The Fancy. Our ancient boxer, in fact, has "got his gruel." He bears severe marks of recent "punishment." Drops of blood are marked here and there — his beard seems blood-clotted, his ear is torn, one eye is closed — in phrase of the Fancy, again, "the shutter has gone up," his front teeth appear to be missing, and, as he sits with his hands and forearms still bound with the metal-loaded cestus, he seems to be nursing the right hand on his knee as he covers it up with his left; the unclenched thumb and fingers of this seem to be seeking relief from the reaction of the blows which the doubled fist itself delivered. He looks back grimly over his right shoulder as if responding by no means cheerfully to a backer's encouragement to "come again to the scratch." We are left in doubt as to what age thought it worth while to give immortality to such a subject in full-size bronze. We would fain think it was the same that produced the mosaic pavement now preserved in the Lateran Museum with the brutalized animalism of fighters in the arena. It is an example of the refined taste of Homer that if a pugilistic contest could not be missed from the funeral games of Patroclus, he committed it to opponents of no dignity as heroes, and, as if to mark his contempt, assigned the victory to a bully who, in asserting his prowess in the ring is not ashamed to own openly that he makes no pretence to distinction in the ranks of battle. The other erect statue is of a nobler type.

A republication of the well-known Sosias vase is justified by a claim to superior accuracy. How much expression a vase-painter could throw into a face when he pleased is seen in that of the wounded Patroclus whose bared arm is being bandaged by Achilles with all the skill and composure of a trained-hospital attendant.

Other plates bring us back to the acropolis of Athens and the Parthenon; one exhibits the marble head of what might be Athene, but that it more resembles a simply pretty girl who has set herself off with a helmet, which was evidently copied from that of the chryselephantine Athene of Phidias. Two other plates are welcome as presenting by photographic agency and at three-quarter size, the drawings by which Carrey preserved a record of the pedimental sculptures of the Parthenon before the ruin which befel them by the Venetian bombardment. Many of the statues which he saw in place have perished entirely; but much value attaches to his record of the positions actually occupied by those which remain. This applies especially to the three figures which represent the Fates; they are here shown to have been united in the very closest possible of groups — a protest, if ever protest were available, against the violence of modern theorists in rending them apart, and so having an apology for renaming them.

But it is time to return to our architectural theme. The excavations on the Athenian acropolis fortunately took place under the eye of Dr. Darpfeld, accomplished as an architect as well as an archæologist, and to whom we owe much, conjointly with Dr. Schlieman, in respect of the architectural revelations on the acropolis of Tiryns. The plates before us are records of his observations and inferences. One unexpected result of these investigations was the uncovering the substructions of a hitherto entirely unknown hexastyle temple, which was situated between the present Parthenon and the Erechtheum. It was indeed so close to the latter that the later-built portico of the Caryatides was built over its stylobate and the north-east angle of this stylobate is just encroached on by the flank wall of the small temple. One stone of this stylobate was found *in situ*, and several of the lowest steps both front and flank, and foundations of all the walls and cross-walls of the cella. The plan on the front step was nearly a double square (21.34 m. : 43.44 m. = 70 ft. : 142.5). The diameter of the column is 1.74 m. (= 5.9 ft.)

The three central intervals of the columns in front are given as somewhat wider than those on flank, which agrees with the Archaic temple at Ægina, and the still earlier one, of which a few columns remain, at Corinth. The dimensions supplied do not enable us to work out exactly how this was managed. There are twelve columns on flank, and if the normal contracted spacing of columns by the angles were the same on both front and flank, the equal deduction from the smaller dimension would throw the difference for the ordinary columniation the other way. The distribution of the cella is peculiar. Rather the smaller half was given to the pronaos and the naos, or proper apartment of the divinity, which like that of the small Ionic temple on the Ilyssus was exactly equal in length and breadth. The posticum *in antis* admitted through a door to the opisthodomus, and that again to two inner chambers, right and left, which may be safely styled treasuries.

On a second plate we are presented with a front elevation, but with the conscientious warning that neither the slope of the pediment nor the height of the column, nor, again, the precise profile of its echinus are determinable. We, therefore, unfortunately lack precisely the characteristic features which are required to determine the true relation of the monument to other archaic remains of Greek architecture. The details of the entablature were partly obtained from the excavation and partly found built into the northern wall of the acropolis. But on this point there is something more to be said.

Now this temple is believed by Mr. Darpfeld to be that of the tutelary goddess of Athens, which was burnt by the Persians. This is in accordance with the view of Colonel Leake, who, having regard to the statement of Hesychius that the later temple exceeded its predecessor by fifty feet, concluded that this first must have been hexastyle. Mr. Penrose fell in with this opinion and in his "*Principles of Athenian Architecture*," he entertained no doubt that both temples were on the same site and, disregarding the extension of an anterior sub-basement even beyond that of the Parthenon, that the first plan was fully included within that of the second. But we are now called upon to revise much of this.

According to Dr. Darpfeld, this earlier basement was that prepared for an octastyle temple by Cimon, with the unusual number of nineteen columns on flank. This, it is assumed, was not far advanced when the accession of Pericles to power made as momentous changes in the artistic development at Athens as in public policy. The Parthenon of Pericles, Ictinus and Phidias is upon the same axis but slightly broader, and shifted so far towards the north that its northern cella wall has the advantage of the foundations of the superseded exterior colonnade. All this may be so, though we should like to have the precise evidence and argument in detail before yielding full assent. The narrow proportions ascribed to Cimon's plan, eight columns by ten columns, cause some hesitation: true, the last advices from Athens quote the authority of Dr. Darpfeld for the temple of Jupiter Olympus there being octastyle and having twenty columns on flank, contrary to all very strong presumptions hitherto that it was decastyle; but the narrowest plan actually certified to the present time has been that of the temple at Bassæ, which has six columns front and fifteen flank.

Then, as regards the members of the entablature which are here taken from the northern acropolis wall to be restored to the hexastyle temple: there are some cogent reasons for suspecting that in reality they must have belonged to an octastyle temple, and the presumption is, in consequence, that they were prepared for the superseded Parthenon of Cimon. Mr. Penrose wrote of them thus: "In these two groups the length of the architraves and the breadth of the triglyph and mutules vary considerably, while the measurements of the metopes are nearly the same and the height is identical in both. This latter circumstance and the similar character of the details, clearly point out that they belonged to one and the same building." Here a certain difficulty arises; Mr. Penrose continues: "The upper surface of the stones forming the cornice to the broader or westernmost group is inclined; in the other it is parallel to the horizon, showing that the former were placed on the flanks and the latter on the fronts of the building to which they belonged." This, it will be seen, contradicts the restored plan which would assign the longer architrave-stones to the front; yet it is difficult to understand that there is a mistake in the record. The difference of the mouldings of the mutules which are required to answer to the difference of triglyphs would have made a false adjustment of cornice manifest at once. Plate 40, of Penrose, confirms the text in giving the sloped line of cornice-top to the western group.

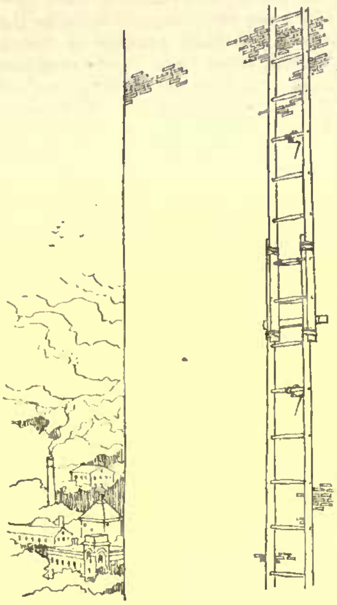
It is further to be observed that if the four shorter architrave-stones were, as they appear to be, duly built into the wall in their proposed juxtaposition, they would not have belonged to a hexastyle temple, as in such a front only three architrave-stones, ending at each end with half a guttæ band, are accommodated.

We are left, therefore, to inquire, were these architrave-stones prepared in fact for the octastyle temple of Cimon or did they really belong to the older temple? In the latter case, we are thrown upon assuming a lapse of pen or memory on the part of Mr. Penrose in assigning the sloped cornice to the wrong set of stones — to the long western instead of the short eastern.

W. WATKISS LLOYD.

LOSS OF LIFE BY THEATRE FIRES. — The record of burned theatres contains the following disasters which have been most destructive to human life: Amsterdam, Schouwbourg Theatre, May 11, 1772, 25 victims; Saragossa, Coliseum, November 12, 1778, 77 victims; Paris, Opéra, June 8, 1781, 21 victims; Capo d'Istria, June 8, 1784, 1,000 victims; London, Covent Garden, September 20, 1808, 22 victims; Richmond. Va., December 26, 1811, 72 victims; St. Petersburg, Lehmann Circus, February 14, 1836, 800 victims; Canton, May 25, 1845, 1,670 victims; Quebec, Theatre Royal, July 12, 1846, 200 victims; Carlsruhe, Court Theatre, February 28, 1847, 100 victims; Leghorn, June 7, 1857, 100 victims; Philadelphia, Fox's Theatre, June 19, 1867, 28 victims; Shanghai, Chinese Theatre, 1871, 120 victims; Tien-Tsin, Chinese Theatre, May, 1872, 600 victims; Brooklyn, Conway's Theatre, December 5, 1876, 380 victims; Sacramento, December 10, 1876, 110 victims; Ahmadnuggar, E. I., May 11, 1878, 40 victims; Nice, Italian Theatre, March 23, 1881, 80 victims; Vienna, Ring Theatre, December 8, 1881, 1,100 victims. These dates and figures are taken from a French work, and do not, in all respects, agree with other authorities. The loss of life at Quebec, July 12, 1846, is elsewhere set down at 47.

LADDERING A TALL CHIMNEY.

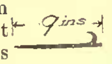


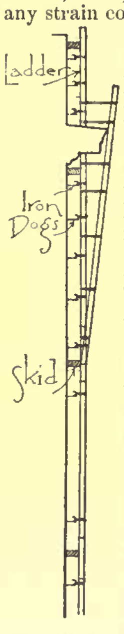
FIFTY years ago Messrs P. Dixon & Sons of Shaddongate Cotton-Mills, Carlisle, built a tall chimney-shaft, which is a land-mark for miles around, in connection with their factory. This shaft is described in Bancroft's treatise on "*Tall Chimney Construction*" as being of the following dimensions: Height from foundation to top 320′ 6″, and from ground-line 300′. Outside measurement at ground-line 17′ 4″, and inside measurement 9′ 6″. Outside dimensions at top 9′ 0″, and inside dimensions 6′ 8″. Built to a batter of 1 in 72.

Being the jubilee year of this tall shaft, Mr. Robert Todd, woollen manufacturer, the present occupier, is having it repaired and a new patent copper-rope lightning-conductor fixed on the outside, and has entrusted the work to Mr. Joseph Ball, large-chimney and spire restorer, and lightning-conductor fixer of York Castle, Oldham, Lancashire.

In carrying out this important undertaking, the ascent to the top of the shaft has been made by fifteen wooden ladders of the ordinary type as used by painters made especially light and strong for the purpose, and weighing from twenty to fifty pounds each, according to their length, and of the average width of 11½″ at bottom and tapered to about 10″ at top; skids or distance-pieces of wood are fixed at the back of the ladders to keep them from the brickwork, thus providing a good foot and hand hold for the workmen.

The procedure of laddering is as follows: The first length or section of ladder is placed at the base of chimney-shaft, and a hooked wrought-iron dog or holdfast, made from ⅞″ round rod, about 9″ long is driven firmly into the brickwork 4′ from the bottom of ladder, and a second iron dog driven into shaft about 4′ down from top of ladder, to which dogs the ladder is firmly lashed. The dogs are formed, as will be seen in sketch, thus preventing the lashing to ladders from slipping when any strain comes upon them.





Having lashed the first length, the next step is to place a free ladder against it. This the workman climbs until he can reach about 4′ above the fixed length, and here he drives into the brickwork an iron dog and attaches a pulley-block to the same, then one end of the rope reeved round the sheave is brought half way down a second loose section of ladder placed by the side of the first; the rope being fastened, the second length is hauled up by workmen at the base of the shaft until it is half its height above section Number 1; it is then temporarily lashed to the fixed length, and the steeple-jack climbs up and drives another holdfast into the brickwork 4′ above its (the second length's) top. He then shifts the pulley-block to the upper holdfast and descends. Length Number 2, still attached to the rope at its middle, is then hoisted up to its full height above the first length fixed, which it overlaps two staves and the top of Number 1 and bottom of Number 2 are then securely lashed together, and Number 2 then forms a continuation of the first fixed length. The climber mounts Number 2 length, which is still held by the pulley-block and rope, and drives in a holdfast above, shifts the pulley-block and proceeds with Number 3 as he did with section Number 2, and so on until the underside of cap is reached, and here a difficulty presents itself.

In Messrs. Dixon's shaft at about 10′ down from the top, a stone cornice projects 3′. The length of ladder coming close underneath this cornice or cap was fixed very firmly. Another length was hauled up until its top was about 5′ above the cornice, and then this slanting length was secured to the length below at its foot, at intermediate points, and also close underneath the cornice by lashings or ropes specially made. In climbing this slanting length the workman's back is towards the ground.

A last length of ladder is hauled up and fixed above the cornice, reaching to the top of shaft, and to the bottom of this the top of the slanting ladder is firmly fixed as an additional security, thus completing the laddering of this tall-chimney shaft. The whole operation from beginning to finish occupied five hours.

The shaft is now being pointed with mastic about 50′ down, and two cracks, which are on opposite sides of the shaft, and extend to the bottom, are being repaired.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

MEMORIAL TABLET TO HENRY W. BELLOWS, D.D., NEW YORK, N. Y. MR. AUGUSTUS ST. GAUDENS, SCULPTOR, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial Edition.]

FOR description, see article on "The Growth of Ecclesiastical Decorative Art in America," elsewhere in this issue.

NEW CITY-HALL, HALIFAX, N. S. MR. EDWARD ELLIOT, ARCHITECT, HALIFAX, N. S.

THIS building, which has just been begun, comprises the whole of the public offices of the city, and is situated on the Grand Parade upon a site formerly occupied by the Dalhousie College. The materials are local gray granite for foundations and walls of basement — the freestone being gray Pictou relieved with dark-red strings and mouldings, etc. The roof is to be slated and the lower roof covered with copper.

The total cost is $70,000. The contractors are Messrs. Millikan, of St. John, N. B. The design is the result of a recent local competition of architects.

HOUSE FOR RODMAN WISTAR, ESQ., PHILADELPHIA, PA. MR. WILSON EYRE, JR., ARCHITECT, PHILADELPHIA, PA.

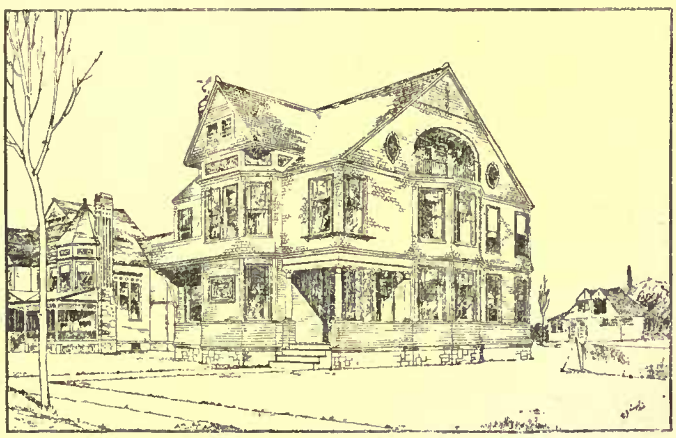
THIS house is now being built at 1014 Spruce Street. The base, quoins, heads and sills, coping, etc., are of New Brunswick stone. The body of the house is of Pompeiian brick.

UNITED STATES POST-OFFICE AND COURT-HOUSE, AUBURN, N. Y. MR. M. E. BELL, SUPERVISING ARCHITECT.

UNITED STATES POST-OFFICE, SPRINGFIELD, O. MR. M. E. BELL, SUPERVISING ARCHITECT.

LA CASA DE LOS MOMOS, ZAMORA, SPAIN.

THE EFFECT OF FREEZING ON CEMENT-MORTAR.[1]



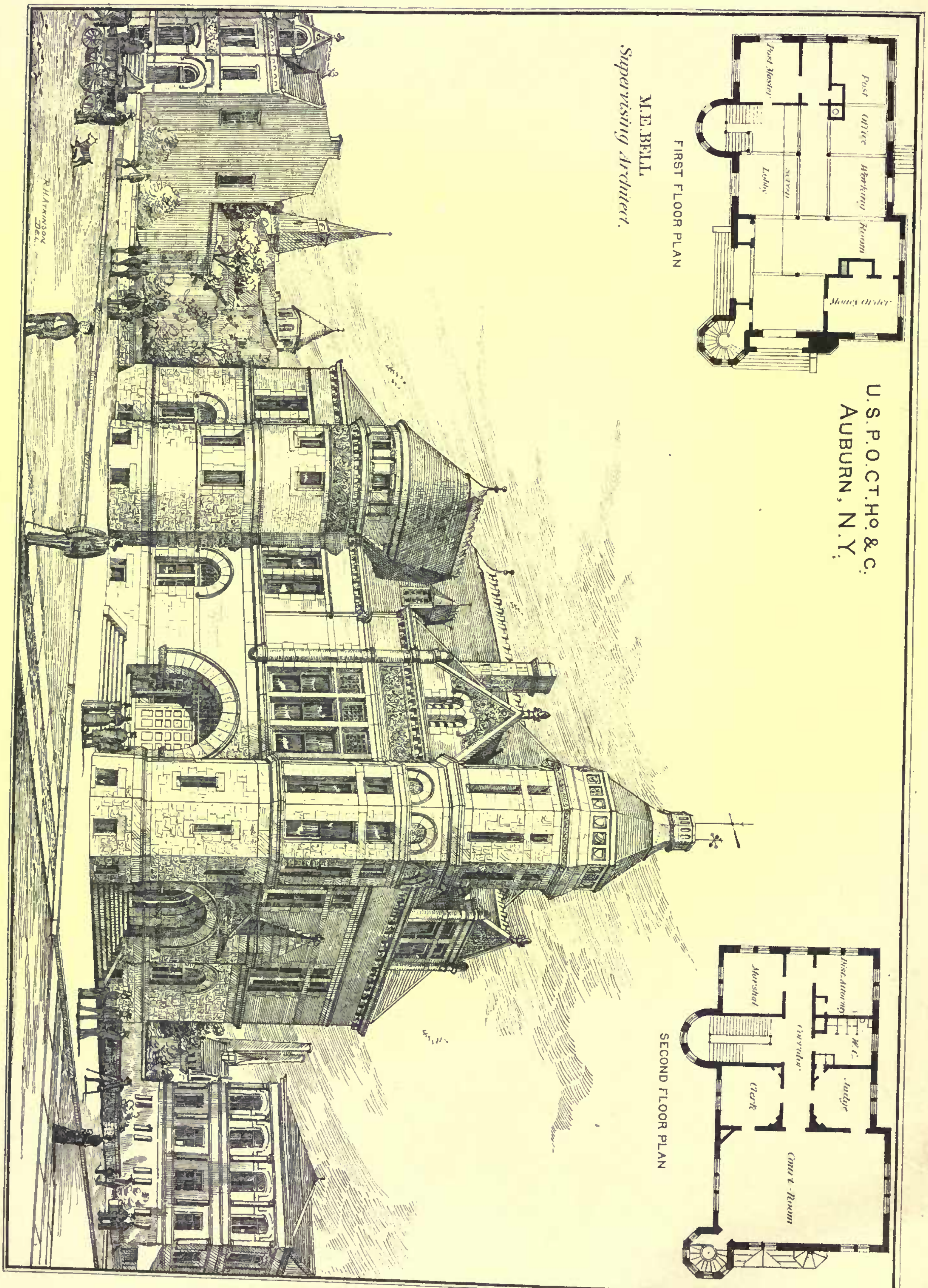
House for William H. Duffett, Esq., Rochester, N. Y. Walker & Nolan, Architects.

IN the construction of a lock at the St. Mary's Falls Canal, the laying of masonry was discontinued about October 20 of each year on account of the frequent recurrence of freezing weather. On the last day of the work in 1877, mortars of Portland cement and of a good quality of American natural cement were used in adjoining portions of the wall. The same proportions of cement and sand, one to one, were used in both classes of mortar. This masonry was laid during a light rain. The following spring the surface of the Portland-cement mortar was sound, showing perfectly the marks of the rain drops. The natural-cement mortar was disintegrated to a depth of three or four inches.

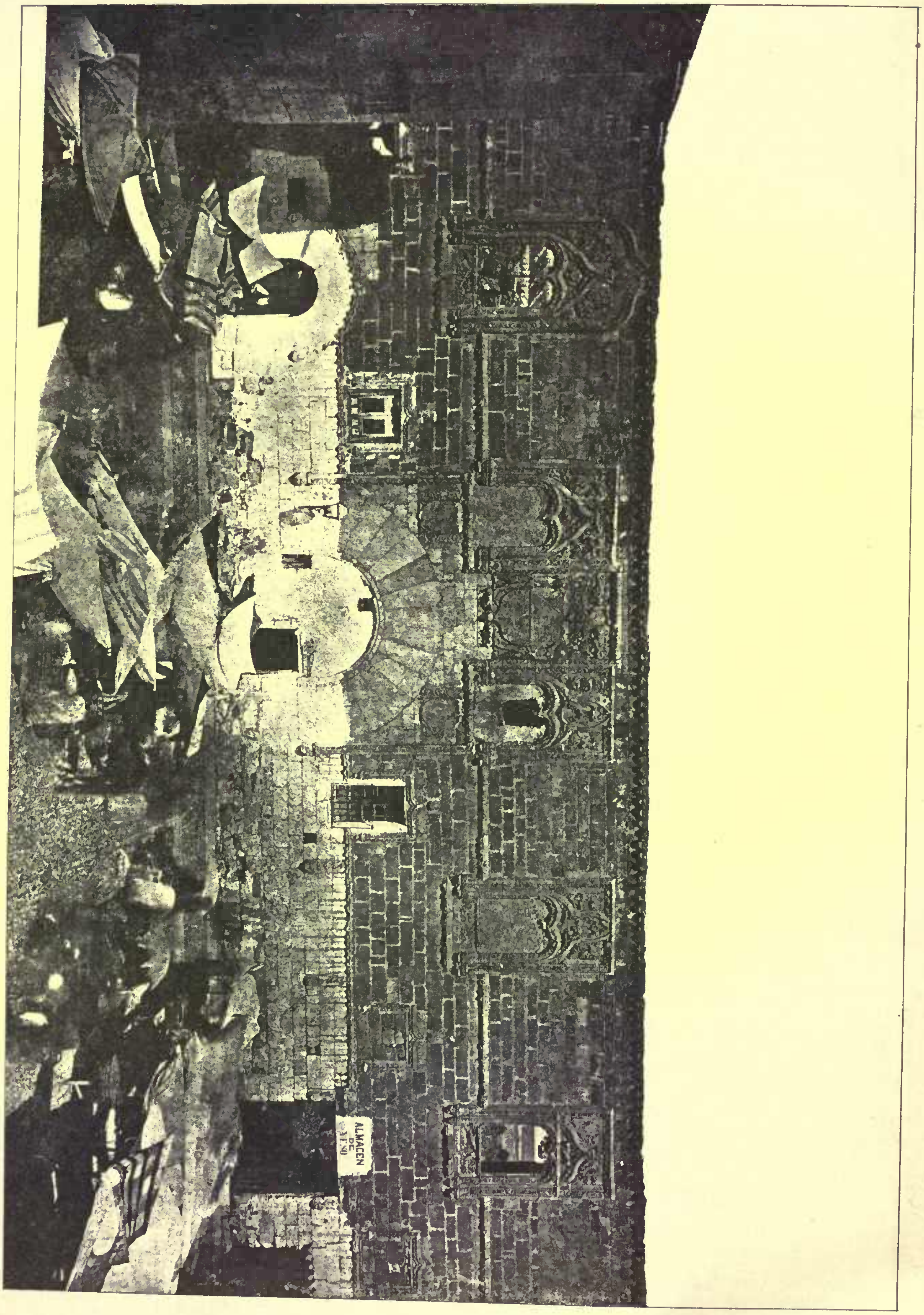
In the same locality it was necessary to lay a concrete foundation for a movable dam in February. The weather was extremely cold, generally about zero. The mortar was made with Portland cement. Salt was used freely, but without retarding very much the freezing of the concrete. The concrete was at once covered with a floor of timber and plank on which the masonry abutments were built. Samples of the frozen mortar set properly after being put in a warm place. There was never any settlement of the masonry, and within a few months the concrete sustained a pressure of fifteen feet of water without developing any leaks.

In the construction of a bridge across the Clark's Fork of the Columbia River in Northwestern Montana, the caissons were filled with concrete during freezing weather. Portland cement was used. The

[1] A paper by Alfred Noble, M. Am. Soc. C. E. Read at the Annual Convention of the American Society of Civil Engineers, and published in the *Transactions* of the Society.



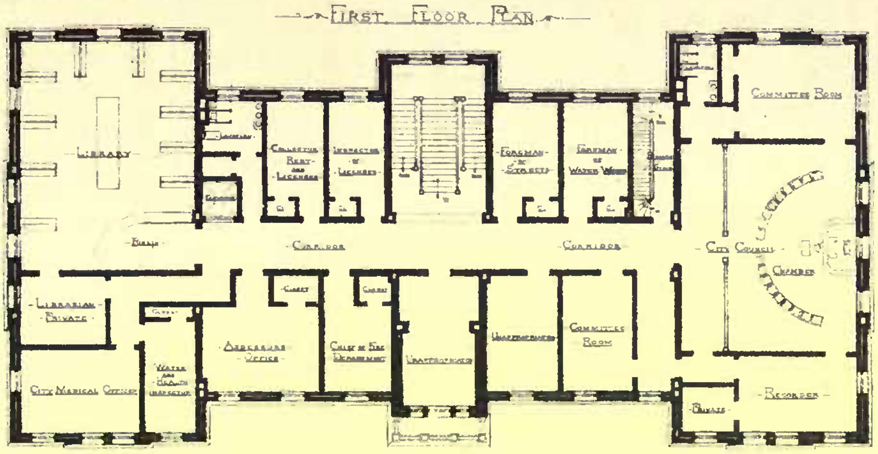
Heliotype Printing Co. Boston.



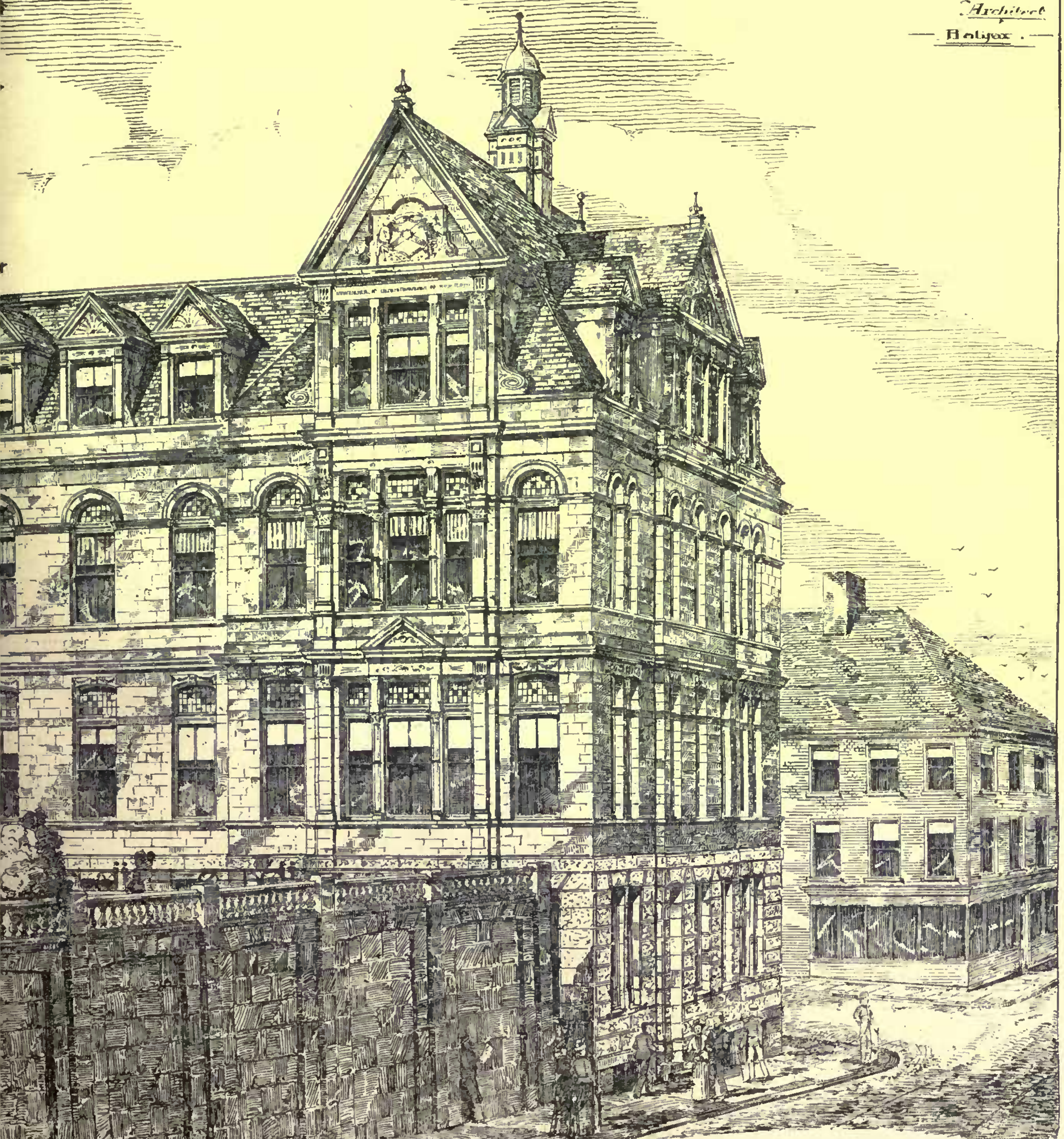
La casa de los Momos. Zamora

Heliotype Printing Co. Boston.


GROUND FLOOR PLAN
Hall
Private Room for Police
Assembly Room for Police
Bench
Police Court
Corridor
Safe
Women's Lock up
Mens Lockup
Lavatory
Mens Cells
Chief of Police
Private
Area



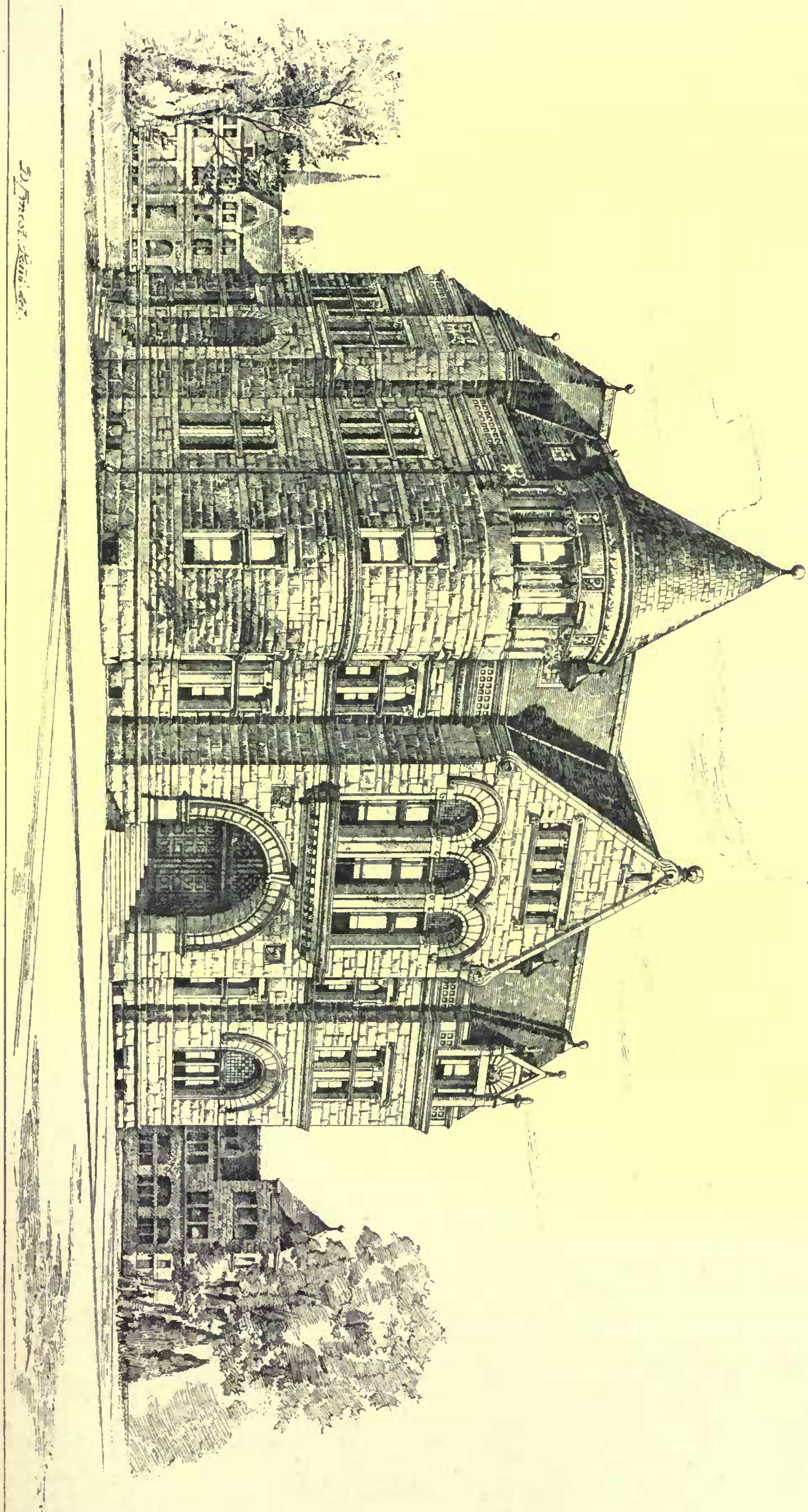
New City Hall
Halifax: N.S.
Edward Elliot
Architect
Halifax.



Heliotype Printing Co. Boston.



Heliotype Printing Co. Boston.



U. S. P. O. &c.
SPRINGFIELD, OHIO.

M. E. Bell
Supervising Architect.

Heliotype Printing Co. Boston.

proportion of cement to sand was one to three. Within a week the laying of stone masonry was commenced on these caissons, and proceeded with as rapidly as possible without apparent injury to the concrete, which had set firmly. In these cases the temperature had risen above the freezing point within two or three days after the concrete had been placed; and it had been permeated to some extent by warm air escaping through leaks from the air-chamber.

Four small piers of the St. Louis River Bridge on the Northern Pacific Railroad, were built near Duluth, in the winter of 1884–5. During the laying of masonry for pier 1 the temperature varied from 0 to 20 degrees; during the building of pier 2 the temperature was about 20 degrees higher, and during the building of the remaining piers the temperature was occasionally above the freezing point. Portland cement was used throughout, the proportions of cement and sand being one to one-and-one-half for face-stone, and one to two-and-one-half for backing. During the extremely cold weather salt was used freely in the mortar and the sand was warmed (not made hot), but with the thermometer at 20 degrees the mortar froze quickly after being spread on the stone; so quickly, indeed, that if the stone, being set, could not be brought to a bearing by a little shaking, it was necessary to raise the stone, scrape off the now frozen mortar, and spread a new bed. In setting the face-stone the mortar was kept back from the face an inch or so to facilitate subsequent pointing. A few weeks later, after there had been milder weather, an examination of the open edges of the mortar-beds showed that the mortar used during the coldest weather had set firmly, and no difference could be detected by examination of detached fragments between the mortars in piers 1 and 4; that is to say, between that laid in the coldest and that laid in the mildest weather embraced in the period of construction of these piers.

During the course of tests of cement at the St. Mary's Falls Canal, a few experiments were made relating to the effect of freezing and the use of salt on cement-mortars. They are not submitted as conclusive in any way, but as suggestive, and in hope that, combined with others, some definite conclusion may be reached.

TABLE A.

EFFECT OF FREEZING ON MORTARS OF PORTLAND CEMENT CONTAINING VARYING AMOUNTS OF SALT.

Composition of Mortar.

Cement .... 35 ounces
Water... 7 "

Salt as in table.

Tensile strength per square inch at seven days.

TREATMENT.	SALT.								
	0.	1/8 oz.	1/4 oz.	3/8 oz.	1/2 oz.	5/8 oz.	3/4 oz.	7/8 oz.	1 oz.
FIRST SERIES.									
Immersed in test-room when removed from moulds............	327	357	375	392	429	402	415	388	402
Exposed to air when removed from moulds and frozen three days; then immersed in test-room four days......	316	378	411	374	415	405	392	383	409
SECOND SERIES.									
Immersed in test-room when removed from moulds............	336	422	421	399	394	384	390	356	387
Exposed to air when removed from moulds and frozen six days; then exposed to air in test-room at 70 degrees one day................	169	198	167	217	227	215	208	221	239

TABLE B.

EFFECT OF MIXING SALT WITH PORTLAND CEMENT-MORTAR.

Proportions by measure.

Cement.. 1.
Sand.. 1.

Proportions by weight.

Cement .... 21 ounces.
Sand .... 23 "
Water... 6 "

Salt as in table.

Means of ten tests.

SALT.	TENSILE STRENGTH, POUNDS PER SQUARE INCH.							
	7 days.	30 days.	90 days.	6 mos.	9 mos.	12 mos.	18 mos.	24 mos.
0..............	155	220	289	311	390	382	402	430
1/8 ounce.......	139	200	246	288	363	364	423	346
1/2 "	139	192	221	289	352	383	392	326
1 "	128	189	217	288	843	369	350	334

DISCUSSION.

F. COLLINGWOOD, M. AM. SOC. C. E. — Mr. Noble said that he found the natural cements did not stand the cold as well as the artificial cements; that he always found the natural cements to be damaged two or three or four inches from the face of the joints after they had been exposed to very severe freezing, and we found something of the same kind in our work on the East River Bridge. On any wide wall where water could collect on top and where it was exposed to the weather all through the winter, we found that we would have to scrape out the joints, but the face-joints never troubled us. We used the Rosendale cements.

GEORGE S. MORISON, M. AM. SOC. C. E. — As bearing immediately upon the subject of freezing, I might mention an accidental experiment that occurred last winter in the work on Omaha Bridge. I had quite a number of briquettes made of American cements and imported Portland cements, which were exposed to the air twenty-four hours and then left in the customary way in a pail of water. There came on extremely cold weather, and the entire lot became a solid block of ice. When it thawed out the Portland cements were entirely uninjured, but the American cements were entirely ruined, some of them being reduced to mud. Subsequent experiments showed that the cements which stood freezing three days after they were made, would also stand freezing immediately after they were mixed. It had been for some years my practice to use Portland cement exclusively in places where the mortar was likely to freeze before setting.

ROBERT B. STANTON, M. AM. SOC. C. E. — I have had some experience in laying masonry in very cold weather. In the winter of 1878 and 1879 it was found that a small pier on the Cincinnati Southern Railway was defective. The pier was taken down and rebuilt with Louisville cement, and with the use of salt. The thermometer at the time ranged from 6 to 10 degrees below zero The iron trestle was put upon the pier, and during the winter no change in the masonry was noticed. When, during the next summer, it became very hot, the pier seemed to sweat; the salt came out and made the sides white, but the cement was as hard as if it had been laid in the summer, and, so far as I have since learned, there has never been any trouble with that pier.

In the winter of 1881, here in Denver, in building the round-house and shops of the Union Pacific yards it became cold very suddenly. After waiting for awhile, the weather not getting more moderate, the work was proceeded with and salt was used in lime mortar, and every night the top was covered with a thick coat of salt; the mortar was not really frozen. The next summer a locomotive got away and struck this masonry between the two windows, tearing away the lower portion and leaving the whole keystone portion above suspended and held up by the mortar, and this masonry hung thus for several weeks: It is possible that the water did not freeze during the day, but during the night the temperature was very low.

ELIOT C. CLARK, M. AM. SOC. C. E. — Some years ago I made a number of experimental batches of concrete, some of Rosendale cement and some of Portland cement. Of these a portion were made with a large proportion of cement, and some weaker, of each kind. I made them just before freezing weather and left them out, being engaged on work in which some concrete had to be exposed in that way.

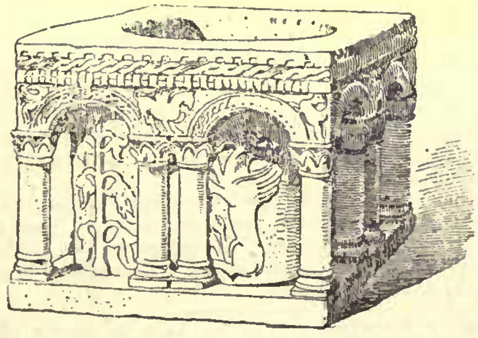
They were left for two or three years exposed, and during the first winter the Rosendale concretes without exception began to weather badly on the surface, and from year to year disintegrated; none of the Portland cement concretes were affected at all in three years, though lying right on the surface of the ground in blocks about a foot square.

I remember once talking with Mr. Shanahan, who is the Superintendent of Public Works of the State of New York, about his practice on the Erie Canal, and he told me that he would as willingly build masonry in the winter as in the summer, so far as its durability was concerned. He used Rosendale cement in building masonry, a tolerably strong mortar; that is, a large proportion of cement to the sand; and always used in mixing only the strongest brine; that is, water saturated with salt so that it would foam on top. He said he never knew a case to fail built in that way.

JOHN BOGART, M. AM. SOC. C. E. — I have had occasion to examine recently the masonry referred to by Mr. Clarke, built upon the line of the Erie Canal. This masonry was the retaining-wall of the West Shore Railroad where it runs along the canal; where it was first laid in very cold weather, without the proper use of salt, it gave way and got into very bad condition. Directions were then given and carried out, for using a strong solution of salt for mixing the mortar, one barrel of brine being mixed when another was being used for mortar. The result has been very satisfactory, and the masonry is in excellent condition.

J. JAMES R. CROES, M. AM. SOC. C. E., replying to a question as to the use of salt, quoted from a paper presented by him in 1874 on the construction of a masonry dam: "In freezing weather the mortar was mixed with salt water. The rule for proportion of salt was one said to have been used in the works at Woolwich Arsenal some years ago, viz.; Dissolve one pound of rock salt in eighteen gallons of water when the temperature is at 32 degrees Fahrenheit, and add three ounces of salt for every 3 degrees of lower temperature. The masonry laid with mortar thus prepared stood well, and showed no signs of having been affected by the frost."

SOME PARIS COLLECTIONS.



WELL-CURB FROM MURANO AFTER L'ART. 11TH OR 12TH CENTURY.

THOSE who cross the Place de Jena each day see an immense building of very bizarre architecture slowly rising in the north angle of the square. This construction is the future museum of all religions, otherwise known as the Musée Guimet. M. Guimet, a rich Frenchman, has given to the State his wonderful collection of Hindo, Chinese and Japanese curiosities, with the understanding that the building in which they are placed shall be called

the Musée Guimet. And, more than this, the donor consents to pay half the sum necessary for the construction of a palace in which to lodge his treasures. Already M. Guimet has spent $200,000, and the government has furnished the same amount. In the first story are to be placed the Japanese and Chinese ceramics; in the second, Japanese and Chinese religions; in the third, emblems of Greek, Roman, and Hindoo religions. I was curious to see all these wonderful *bibelots*, and for that purpose paid a visit to the conservateur, Number 30 Avenue du Trocadéro. Nothing can be more puzzling than the view of these emblems of a past civilization scattered about a modern house. The ceilings are very low, and these monstrous idols seem crushed by some unseen force; the walls are covered with kake-monos, Japanese tapestries, and one of them represents the Japanese Hades. Specimens of the most ancient Chinese pottery are seen in every stage of fabrication; vitrines are filled with Japanese ceramics, old Satsuma ware, Nienzei pottery, etc. Hindoo divinities, a superb Vishnu sleeping on the serpent Cesha and floating on the ocean; a sedan chair that belonged to a Japanese princess and still bears her arms. In a corner are five manikins representing a Japanese scene. By order of the Emperor, two Japanese fight a duel; they rush one against the other, brandishing their lances, while the sovereign's representative, the gohé, watches over the combat. Behind each adversary is his second, who follows the struggle with an interest not always seen on the faces of seconds in European countries. But I shall not make a catalogue. In a few months the Musée Guimet will have been finished, and all these wonders will be classified for the benefit of tourists. Study Baedeker, Contz and other guides, but you will find no description of another museum the equal of the one which I shall tell you about. The Musée de Lutece, which has nothing of an official character, and yet contains the richest collection of Parisian antiquities, is situated outside the fortifications, at Number 16 Rue de Montrouge. M. Eugene Toulouze, the proprietor, who has a great reputation among archæologists, is about forty years old, very simple in manner, but also very sympathetic. For the past twenty years M. Toulouze has occupied his leisure hours in archæological research, always at his own expense. Paris is to him like an open book — on the surface, beneath the surface. It would require a volume to describe and an enormous catalogue simply to name the various objects. There is a Roman ampula. When one of M. Toulouze's workmen struck it with a pickaxe he found it was full of pieces of money stamped with the heads of Valerianus, Gallienus and Marius. The ancients placed on their coffins many utensils, and the Gauls always put a glass beside the head of the dead. In this museum is one of these glasses found beside the skeleton of a woman in the Avenue des Gobelins. Then there are toys of the time of Sainte Geneviève, two thousand years old, but the most wonderful object is a case of surgical instruments that were made in the third century. This was found in a tomb on the border of the old Roman road, between Lutece (Paris) and Genabum (Orleans); probably this tomb was in the surgeon's house, for in those days houses were built over graves. For this case Baron Rothschild offered $5,000, but M. Toulouze refused because his museum would thus lose one of its greatest treasures.

For ten years workmen have been employed upon the structure bounded by the Avenue du Trocadéro and the Rues de Freycinet, Goethe, Pierre Charron and Chaillot. The Musée Galliera would have been finished long ago had not its donor expressed a wish that not more than $60,000 should be spent upon it each year. When finished this museum will have cost $600,000, and will contain all the treasures left by the Duc de Galliera, a Genoese noble, who made Paris his home.

The Trocadéro Museum has just been enriched by a new ethnographical collection, brought from New Guinea by M. Laglaize, and given to the State by Prince Roland Bonaparte. For a long time Prince Roland has occupied himself with geographical questions, and the interest inspired by these studies was so great that little by little he gave himself up to them. Already the Prince has written a volume on the Laplanders. To gather material for this book Prince Roland placed himself at the head of a scientific expedition, and thoroughly investigated Lapland. Lately, the exploration of New Guinea has interested him more, and he gave a large sum of money to M. Laglaise, who has brought him a rare collection found between Darei and the Islands of Urville. All these objects are temporarily placed in the Ethiopian room of the Trocadéro Museum, and arrangements are being made for their exhibition in the entrance hall of the museum. There are hideous masks, funereal statuettes, birds and fish designed for the prows of boats, the roofs of cabins, primitive costumes, nose-ornaments, collars, bracelets, tools, such as wooden spoons and spatula, stone-hatchets, polished in an extraordinary manner, arms and armor, etc.

The musical instruments are little wooden tamborines covered with skins of serpents, and bass drums made of trunks of trees; on each side these gave different notes. Altogether, of the kind, this collection is the most wonderful in the world.—*Baroness Althea Salvador in the N. Y, Mail and Express.*

DECENNIAL INDEX OF ILLUSTRATIONS. — We have in course of preparation a classified index of the illustrations published in the *American Architect* from 1876 to 1885 inclusive. We find that in very many cases the *cost* of the building has not been stated, and we therefore, ask our contributors to furnish us the approximate cost of such buildings of their designing as have been published during the above-named years.

THE DRIVEN-WELL PATENT.



WIDE-spread interest attaches to two decisions which were handed down by the United States Supreme Court at Washington, on the 22d ult. The cases are those involving the use of driven wells under the patents of Nelson W. Green. The brief memorandum furnished by the Court is as follows:

No. 120.—Harris Eames *vs.* W. D. Andrews *et al.*—Appeal from the Circuit Court for the District of Connecticut.—The controversy in this case relates to the validity of what is known as "the driven-well patent." The importance of this litigation and the extent to which the people of the country are interested in it are shown by the fact that the number of driven wells in the United States is somewhere between 500,000 and 1,000,000. The Court holds, first, that the grounds upon which it is sought to invalidate the reissued patent for the driven wells, as being for a different invention from that described in the original patent, cannot be sustained; second, that the invention had not been anticipated by others; and third, that there is a clear case of infringement. The validity of reissued patent No. 4372, issued to Nelson W. Green, is therefore sustained and the decree of the Circuit Court affirmed. Opinion by Justice Matthews.

No. 1320.—A. T. Beedle *vs.* Frank O. Bennett and others.—Appeal from the Circuit Court for the Northern District of Ohio.—This is also a driven-well patent case. Upon the grounds set forth in the opinion in the preceding case the validity of the patent is sustained and the appellant held liable for infringement. The effect of the decision in these two cases is to render all users of driven wells, not authorized under the Green patent, liable to pay damages for infringement.

The cases are notable not only because of the very great number of persons affected by the decisions, but also by reason of the peculiarly bitter contests that have been provoked in divers portions of the country in the efforts made to uphold the validity of the patent in dispute. Western farmers, grangers and others who have been seeking for years to bring about an amendment to the patent laws have made it a point to refer to the Green patent and its enforcement as one of the oppressions of the present system of patents. To most of them, indeed, the driven-well patent and the barbed-wire patents were the two striking features that were especially obnoxious in the system.

The invention itself is more than a quarter of a century old. It was in the summer of 1861 that Nelson W. Green, the Colonel of the Seventy-sixth New York Volunteers, was drilling his men at Cortland, New York. His attention was then called to the subject of procuring fresh water for the use of his men, and he set about to devise ways and means to accomplish the purpose. His idea was to get water from beneath the surface of the earth, thus avoiding danger from poisoned wells and springs, and also from the risk of being cut off from access to the ordinary sources of supply when in the presence of the enemy. He began by driving a sharp-pointed rod into the ground and into the water-bearing stratum, and then withdrawing the rod and inserting a tube, through which the water could be drawn by any ordinary style of pump. The test of the device worked satisfactorily, and Green drove a well between October 1 and 15, 1861, that was used generally by the men in camp and by others. Subsequently the device was made use of by the regiment while engaged in actual warfare, and it proved its undoubted value. During the years of the war and even afterward such wells were sunk in Cortland and elsewhere.

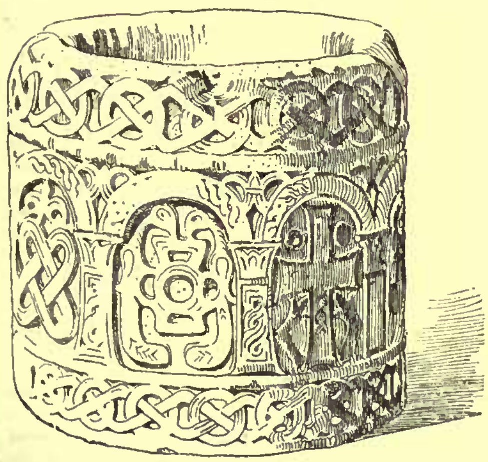
It was not until 1866 that Colonel Green applied for his patent, but before this, patents were issued to others for a similar mechanism. A long legal fight followed. Colonel Green, after years of struggling, succeeded in ousting others from having the legal right to control his invention. Then he and the managers of his patent were obliged to carry on contests all over the country to establish his right to collect royalties. The Federal courts in at least ten States had their calendars crowded with cases involving an alleged interference with Colonel Green's rights. Decisions at Circuit Court were had from time to time after protracted litigation, and in nearly every instance the validity of Colonel Green's patent was upheld. Occasionally, however, and notably so in a case in Iowa, decided in May, 1883, it was held that Colonel Green had no valid patent. The principal grounds upon which this decision was based were that the inventor had abandoned his rights, and had dedicated his invention freely to the public by his failure to take out a patent until after the

lapse of years and until the general public had begun using the invention; and that, furthermore, in a reissue of the patent, which had been obtained after the expiration of the fourteen years prescribed by the patent laws, more was claimed in the reissue than was in the original patent or invention. The principal new matter, it was claimed, was making the joints of the sunken-pipe air and water tight, so that a vacuum could be produced in the well. Judge Benedict described the principle of the invention in these words:

"This well embodies an idea not present in any other form — namely, that the water-bearing stratum of the earth may, by the application of artificial power, be forced to flow from the earth into a well-pit with increased rapidity, so that a well-pit only a few inches in diameter, sunk to a moderate depth, will afford an abundant supply of water, and constitute a practical and productive well. . . . The foundation of this new form of well is the discovery that if a pipe with an opening of the lower end be driven into the earth extending down air-tight until it reaches water, and have a pump attached air-tight to its upper end and a vacuum be created the pipe so fitted, and connected with the water in the earth, water will flow abundantly from the earth into the pipe. The novelty consists in making the well-pit to consist of the tube of a pump connected tightly with the earth."

The decisions of the Supreme Court announced yesterday uphold the validity of the original patent and of the reissue. They bring to an end a legal fight of fourteen years' duration, and will result in causing the holders of the patent and reissue to receive millions of dollars for royalties and infringements. It is commonly believed that such wells are used only to obtain comparatively small amounts of water. This idea is erroneous. In Newark, N. J., the system was put in operation to supply 260,000,000 gallons of water in four months, and a similar system was applied to increase Brooklyn's water-supply by about 10,000,000 gallons per day.—*Iron Age.*

THE CATHEDRAL OF ORVIETO.



WELL-CURB FROM MURANO 9th CENTURY AFTER L'ART.

LOOKING over the various objects preserved in the Archivio of Orvieto, the architect in charge of the restorations, Signor Zampi, one of the thoughtful and faithful restorers who, I believe, can be found nowhere but in Italy, pointed out a worm-eaten and faded drawing on parchment of a façade, evidently a scheme of that of the Cathedral, differing essentially from the actual façade of Maitani, but with so many features in common that is was clearly an earlier scheme, abandoned for that actually carried out. What had directed the conjectures of Zampi to the probable authorship of the earlier plan was the fact that the famous pilasters of the façade, containing the Bible history in a series of bas-reliefs known to have been made by the pupils of Niccolò Pisano, were given in the elevation as they now are, in a series of designs on so small a scale as to be scarcely distinguishable except with a lens. This to Zampi pointed to the identity of the designer of the bas-relief and the façade; and, in his opinion, this could be no other than Arnolfo di Lapo, who was, in fact, designated by the most ancient records as one of those who executed the reliefs.

As I had brief time to give to the question there, I got the documents concerning the cathedral and set myself to work-out the problem of which I was convinced that Zampi had indicated the solution, leaving only the demonstration to me. The study of the design in question side by side with that known to be by Maitani, and signed by him, which is also in the Archivio, gave me satisfactory internal evidence that the anonymous design was earlier, and inspired by a finer taste, than that on which the façade had been finished — the differences, which were not inconsiderable, being mostly variations of the original ideas in the direction of heaviness and elaboration; and I was satisfied that the man who was capable of designing the abandoned one would never have adopted that actually executed. The lower part of the façade is the same, but above the side doors in the original the tympanum springs lightly up to near the level of the eaves of the church like an inspiration, while the executed design has a double tympanum, totally devoid of the airy grace of the other. The original is basilical, with a graceful fall of the line of the cornice from the central compartment to the eaves, the central alone preserving the triangular tympanum, while the actual front is tricuspidal. One must see the two side by side to judge of the immense superiority in lightness and variety in composition of line of the original. The tricuspidal termination had always distressed me somewhat, but I could not tell why until I saw the other plan, and then I was convinced without argument that the original plan had been to build the façade with a basilical termination. The central square window is in both, but the frame is enlarged by the addition of the double row of statues around, and the gallery beneath is added. In the original plan, designs fill every space reserved for mosaics, as well as all the surface of the broad pilasters which divide and flank the doorways.

The study of the documents disclosed the following facts. In 1285 the bishop and council of Orvieto decided to build a new and more magnificent church in honor of the miracle of Bolsena and under the dedication of the Madonna. The minutes in the archives says: "In nomine Domini, Amen. Anno 1285, Indictione XIV, Tempore Martini PP. IV, die tertia Martii. Cum in nova Ecclesia construenda ad honorem B. M. V. sicut tractatum est per Ven. D. Franciscum Episcopum Urbevetanum et stabilitum per consilium Civitatis oportet destrui cameras quasi omnes Archipresbiteri et Capituli, etc., etc., etc., pro soli ubi dicta Ecclesia construi debet, etc." In February, 1288, three pounds and twelve soldi are paid for the carriage of one hundred and forty-three stones for the work on S. Maria, and on July 16 of the same year Giovanni Scrimario is paid three pounds for work done beyond the time which had been stipulated and probably paid for. In 1290 Nicholas IV laid the corner-stone with magnificent festivities. In 1292 a tax was laid on all the towns, castles, etc., then subject to Orvieto, whose rule extended from Empoli to Orbetello, to hasten the construction of the church, which it was intended to make the most magnificent in Italy. Up to 1293 the contributions amounted to 3,362 pounds, a much larger sum relatively than would be that figure in sterling to-day. In 1295 Fra Benvegnate was called in as master-builder to superintend the work, and in 1300 he was given full authority over the under-masters and workmen, in the selection of whom Orvieto people were to be preferred, other things being equal. The captain and seven consuls ordered "quod F. Benvegnate sit operarius [superintendent] Ecclesiae S. Marie *sicut fuit antea*, cum salario sibi ordinato per litteras olim Episcopi Urbev." In June, 1310 the council and captain decided that it was necessary to get the marble for the façade, "quod necessarium sit facere deportari marmora de contrata Montis Pisi et a Civitate Ortana et aliis contratis pro edificandis in pariete anteriore dicte Ecclesie."

In 1309 Boniface VIII (not Guido Farnese) said the first mass, and in September, 1310, the Council proposes to call in Lorenzo Maitani, "quod magister *Laurentius* olim magistri *Vitalis* de Senis, universalist caput magister ad fabricam supradictam; pro parte comunis [*sic*] Urbevetani multocties requisitus, venit ad civitatem Urbevetanam ad reparandam ipsam fabricam, que quasi minabatur ruinam, et ad hedificandam eandem" (Documenti raccolti dal Dott. Milanesi, Siena, 1854, Tom I. p. 172.) The church was going to ruin, and he was called in to repair it, which does not indicate that he had been the original architect, since, had that been the case, there would hardly have been the confidence in his ability which was shown by the Orvietans. "Multocties requisitus" does not mean had *come* many times, but had been called many times; and, with all the cataloguing of the sculptors and workmen employed on the church from 1285 down to 1310, no mention has ever been made of Maitani.

But who was Maitani? Milanesi, in his "Documenti, etc.," says, after quoting the above-mentioned document: "Here we have Lorenzo Maitani, the celebrated architect of the Duomo of Orvieto, whose fame we may say began about 1310, as we know not from an earlier date what work he did. In Siena he is scarcely known [*ricordato*], and though I have with great diligence and love searched the records for news of him, I have found very little before he went to Orvieto." He was, by this search, shown to be the son of a master-mason and builder, Vitale di Lorenzo, and beyond this and his coming to Orvieto we know nothing. The assumption that he was the first architect of the Orvieto Cathedral is without any other basis than I have given — too little to overcome the arguments against it, of which the two designs and their relation to each other are chief as internal, and the total absence of mention of him conclusive, taken in connection with the other. I cannot, in the space you can afford, go in detail over the whole ground, but this is the general solution I suggest.

We know that Arnolfo was at work in Orvieto between 1280 and 1288, and left the monument of Cardinal de Bray, still in the church of S. Domenico, as a testimony of his presence and abilities. The good folk of Orvieto had been disposed in the first place to make the cathedral a copy of S. Maria Maggiore, then the typical basilica of the church, less splendid, but probably (its glories are now hidden by a barocco shell of late incrustation) far more pleasing to the thirteenth century taste than St. Paul-beyond-the-walls; and commissions were sent to Rome to get the plans to build by. But the façade is not borrowed from anything Roman. If, however, one will compare its motive of decoration with that of the tomb of Cardinal de Bray, he will be struck with the similarity of the decorative feeling to that of the façade, and the architectural character of the tomb. With the intervention of Arnolfo for the design of the façade and the known participation of the pupils of Niccolò Pisano in the execution of the bas-reliefs, the Urbevetani thought, not without reason, that they could trust a master-builder to build the body of the church on the proportions of S. Maria Maggiore. In 1295 Fra Benvegnate, who was pretty certainly the same who had been

engaged with Niccolò Pisano and his pupils in Perugia, and was superintendent of the construction of the Duomo there, was called in; and since, in 1298, Arnolfo was definitely and more honorably employed in Florence, he probably abandoned Orvieto altogether, and then Benvegnate was made master-builder with a control over all subordinates, masters, and laborers — which was absolutely inconsistent with any authority or participation of Maitani. Benvegnate, if superintendent of Perugia with old Niccolò of Pisa, must have been an old man, and probably gave out ere long, as Niccolò is supposed to have died about 1290. I conclude, then, that Maitani was called in only when, after Benvegnate's death or retirement, the work began to decay from neglect and want of authority to direct the workmen and secure the quality of construction considered necessary. The people made their festivity when the church was finished, and forgot who had begun it half a century before. This is how history was then written. — *W. J. Stillman, in the N. Y. Evening Post.*

SOCIETIES

MASSACHUSETTS INSTITUTE OF TECHNOLOGY. — THE PRIZES OF THE BOSTON SOCIETY OF ARCHITECTS.

THE committee of the Boston Society of Architects has awarded the annual prizes of the Society for the best work of the year in the department of Architecture of the Massachusetts Institute of Technology as follows: a first prize to Thomas R. Kimball, of Omaha, Neb.; a second prize to Dwight H. Perkins, of Chicago, Ill.

Honorable mentions were awarded to Wm. W. Bosworth, of Roxbury, Mass., and Howard G. Hodgkins, of Boston, Mass.

In the third-year class honorable mentions were given to Geo. C. Shattuck, of Nashua, N. H., and Henry F. Bigelow, of Clinton, Mass.

The prizes are given in books, of the value of fifty dollars.

BOOKS & PAPERS

ANY one who studies the history of French art can readily appreciate the changes that have taken place in the national artistic thought and its expression. At the beginning of the present century David was the universally accepted criterion, and his cold, classic figures, his theatrical compositions and academic coloring exercised such an influence upon the artists of his time that few ever ventured to dispute his authority or his taste. The change from the style of his school to that represented by the works of such men as Bastien-Lepage was brought about mainly through the influence of three men: Prud'hon, Gericault and Decamps; each different in his way and contributing differently towards the general development of art; Prud'hon being all grace and delicacy in his conceptions, dealing with *chiaro-scuro* effects and soft moonlight rather than the glare of noontide; while Gericault was strong and almost brutal in his treatment of subjects, selecting the rudest themes and dealing with them in a way which compelled his rivals to respect his genius. Decamps was keen-sighted, very sarcastic in his feelings as in his paintings, self-willed, a wonderful draughtsman and utterly independent of all schools. With such a trio we can understand that art should change and change very rapidly, although in considering the transformations which have actually taken place it is easy to appreciate that the individual promoters of such a change should sometimes be lost sight of and almost forgotten in the light of the greater works for which they themselves prepared the way. It has been thus with Decamps, perhaps more than with either of the other painters. We venture to say that few of our readers have heard his name mentioned at all, and, indeed, it is only by his influence on others that we on this side the ocean are able to judge of his talent. The art connoisseur who has given himself the delightful task of rambling through the old curiosity shops of Paris will remember his name in connection with his numerous lithographs and caricatures which are displayed in so many of the old print establishments; but he painted so entirely for the moment, and his subjects and renditions were so essentially local that he really has not a very widely extended fame.

Alexandre-Gabriel Decamps [1] tells us himself that he was born the third day of the third month of the third year of this century, and that no other prodigy marked his birth. He seems to have been of anything but a pleasant disposition, and at a very early age his parents sent him into the country keeping him in the South of France until he grew to be quite a lad. Decamps never forgot his early rustic experiences, and when he returned to Paris it was with such pronounced rural tastes that he found little sympathy in the city life which awaited him. However, he tried serious study in the schools and endeavored to follow the weary routine of the art student, but became disgusted with the whole system, left the studio and essayed some pictures on his own account after his own manner, in the privacy of his room. To his surprise he found that they sold readily, and thenceforth his education as a painter was lacking entirely. He began by making caricatures, and speedily won a position as editor of *La Caricature.* He can almost be called the founder of the modern school of cheap French illustrators, and to-day, in the works of Mars, Grévin and others of their stamp we see how strongly Decamps must have impressed his originality on this particular line of art; indeed, on first glancing through Mr. Clément's biography, one is inclined to think that Decamps was nothing but a caricaturist, and that he hardly thought of anything else; but a little investigation of the volume will soon make it evident that though he at first gave himself so completely to lithography and caricature, it was more as a means of earning his living. He had higher thoughts of his calling, and as soon as circumstances permitted he began to develope a very different kind of art, both in subjects and in style.

When about twenty-five years of age, he made a long journey through the Levant, returning thoroughly captivated with the Eastern life and scenery, and the opportunities they gave him fer displaying his own particular feelings as a painter. His work, from the time that he began to travel shows a curious combination of what we might style Thomas Nast and Gustave Doré, if we may be allowed to compare him with more modern artists, though Decamps had the good qualities of both and the bad ones of neither. He drew to perfection; indeed, few artists have ever had the wonderful facility of hand which he possessed. It was, however, a facility rather in the line of originality of composition than of making mere copies, for in his later compositions he seems to be perfectly at home with all his figures, twisting them about, posing them in all attitudes, seemingly never at a loss for movement. Hardly since Rubens has there been a painter who could so think in living forms and put such a wonderful amount of movement into his pictures. Nor was he lacking in sentiment and feeling. He was poetic by temperament to a certain extent, and was endowed with considerable creative imagination; but in the execution of many of his works he displays such a brutality of touch, such tenacity of the leading ideas and care for details, that while his compositions were sought for, they can hardly be said to have been admired. He was always perfectly at home in whichever medium he chose to select, in this respect preparing the way for the modern French school, which is inclined to disregard the medium almost entirely, and to consider that it matters not whether the artist works with paint, pencil or charcoal, so long as he finally arrives at the desired effect. When we consider that all this while Ingres was captivating Paris with his delicate productions, that David was hardly off the field as yet, and that the romantic element in art was only beginning to die out in France, we see how strong must have been the individuality of Decamps to paint as he did, and be so utterly indifferent to the canons of the ruling academic taste; though, for that matter, it may be that as he never had any training except what he gave himself, it was not so difficult for him to move against the current.

As he grew in public esteem and began to acquire certain wealth and position, he gave himself up more and more to the particular lines of art that pleased him most, abandoning lithography and caricature, and dealing almost entirely with landscapes, but landscapes of a kind that have never been made since the time of Poussin. With Decamps, trees, rocks, rivers, everything were merely means of expressing a thought. It mattered little to him whether he represented a tree as a tree, or whether the river flowed up or down, if only the picture had the desired effect and told its story truthfully. But although he was so vigorous a painter and put such tremendous energy into his work, he was by no means lacking in a much finer sentiment which crops out again and again. Some of his paintings in which he deals with misery or with peasant life have a great deal of feeling in them, not unlike that which gives such a charm to the work of Jean François Millet. Not that he is to be compared with the more modern painter in the truest artistic sense, but still he had the same thoughts at times. If his life had been less occupied with combatting ideas which he felt were false, and ridiculing art which he knew to be lacking in life, he would undoubtedly have developed into a gentler vein. As it was, though his work may at times have seemed unpleasant or even positively bad in its quality, he always appealed to the intellect, forcing those about him to think and thus opening the way for the progress which has come since his time. He did not learn his art in the schools; he thought with his pencil at an age when others were designing after the antique and the model, or forming and developing their tastes in regular studies. He spoke a patois in his infancy, and if his artistic language is eloquent it is not always elegant or correct.

Decamps was one of the very few artists who lived to find himself weakening in artistic powers. The fervor of his art-feeling literally wore him out, and before he was fifty he began to fail, showing unmistakable decadence. He lingered on, growing feebler in art and body until 1860, when he died, at fifty-seven years of age.

His influence on art was enormous. Not so much by what he did, though that was very considerable in quantity and quality, but by what he inspired or shamed others into doing. No one could be mawkishly sentimental with such a man as Decamps about, and art could never become effete while receiving such vigorous impulsions as he gave it. He was not the founder of a school, in the artistic sense of the expression; rather he was the destroyer of one, running

[1] "*Les Artistes Célèbres: Decamps,*" par Charles Clément. Paris: J. Rouam, Editeur.

full tilt in the vigor of his young manhood against the tame, correct classicality of the David school; ridiculing, caricaturing, abusing his contemporaries into opening their eyes, looking for themselves and mixing brains with their colors, until he was feared if not respected by all his opponents, and until the rising generation of artists, the young men who feared neither the Bourbons nor Louis Philippe, and were ready to caricature the weaknesses of the one or fight against the insidious politics of the other, were all eager to range themselves on his side; to paint as he painted, to choose his subjects, to imitate his methods and processes, to see Nature by his eyes. It was through Gericault and through Decamps that painters of our times have been able to find style and character in modern subjects, truth in the old masters and life in everything. That he should often have been crude and uncouth in his art is not strange. A man who uses the force of a sledge hammer can hardly paint with the delicacy of a miniaturist; but his impulses were always in the right direction, and he supplied force and vigor to the national art-growth when it was most in need of a healthy treatment.

Mr. Clément's biography is very good and readable; a little prolix in the introduction, but full of interest where it deals with the painter's work, and made doubly valuable by the fifty-seven lithographs and engravings scattered freely through the work.

COMMUNICATIONS

WICHITA, KAN.

WICHITA, KAN., May 21, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Amongst the new cities of the great West there is none perhaps better advertised as a market for speculation in real estate or less advertised as to its building "boom" than Wichita. Throughout the Middle and New England States, Wichita is well known, but only as a gold-field might be known and not as a solid, substantial city. Many imagine there is nothing but a real-estate boom here, and very few have any conception of the enormous amount of building that is backing up the rapid rise in property.

Wichita deserves note, as she never has had an equal in point of growth, and probably never will have. In the past twelve months she has increased from 22,000 to over 35,000 inhabitants, and only in 1870 the town was laid out and incorporated. To-day she is the metropolis of the State, and has tributary to her probably the richest and most extensive agricultural section of the Union, and where is there better backing? And what is the secret of Wichita's greatness in the near future is the fact that the surrounding country is only beginning to be developed, and Wichita to-day is more than four times as large as any town within a radius of over two hundred miles.

Three years ago there was a singular sign hung out for the notice of the public. It was singular as having never been seen before in this part of the world. It was simply, "E. Dumont, Architect." "It was mighty poor picking for the first year," as this "first architect" states it, but to-day there are no less than fifteen architects with work in abundance, and the general complaint among them is the lack of first-class draughtsmen such as the class of work here demands.

To give some idea as to the amount of building under way, I will venture to say that there will be *three thousand* buildings erected here, and averaging $2,000 apiece, between the months of February and December, 1887. Some do not hesitate to place the figure for the year at $10,000,000. There are hundreds of residences to cost over $10,000 apiece, one to cost $45,000. One hotel to cost nearly $100,000, and if the pressed-brick business fronts were strung in a continuous line, they would extend over half a mile and average three stories high. There are five churches building, two of stone, and one, the St. John's, to cost over $30,000. But of all building lines, the greatest is in educational institutions. There is building the Garfield University, to cost over $100,000, the Fairmount College, the Judson University, the Lewis Academy, the John Bright University, the Catholic University, the Wichita University, and not one of these buildings will cost, completed, less than $30,000, and the total expenditure necessary to place all these institutions, with all tributary buildings, open to the public will not fall under $1,000,000. Besides, there is the $100,000 Government Building and a $75,000 opera-house building. Sixteen years ago there was n't a house (excepting only a few "dug-outs") on this beautiful rolling prairie. A few envious newspapers in the Middle States are trying to make their less fortunate readers believe such an absurd thing as that "the bottom has fallen out of Wichita." The fact is the building and business development is far surpassing the most sanguine expectations, and the Eastern individual, holding deeds to some of Wichita's valuable real estate, who has given ear to the silly tales of his local newspaper, has been most beautifully "taken in," for, in his eagerness to sell his property, he has accepted one hundred per cent advance, while it was worth perhaps three hundred per cent above his purchase price.

On the 17th inst., the State Association of Architects met in Wichita, that being the date of their semi-annual conclave. There was quite a number present, but this being the busiest season throughout the State, many were kept from attending by press of business. One important action taken by the Association was the passing of resolutions to let the plumbing of buildings *separately* in all cases possible.

There seems to be an impression prevalent amongst Eastern draughtsmen that this country is in a semi-barbarous state and hardly safe or fit to live in. It has been very difficult to induce good draughtsmen to come west of Kansas City, while, if they only knew it, there is n't a better field for a few than the State of Kansas. The demand, however, will soon bring a supply. The next ten years will witness such development throughout the State of Kansas in general, and in Wichita in particular, as the world has never seen. Yours truly,

A. W. HAYWARD.

TRINIDAD ASPHALT.

NEW YORK, May 31, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Replying to inquiry in your Saturday's paper, "Will Trinidad asphalt placed on the exterior of stone walls underground for a damp-course, decay?" would state that Trinidad asphalt being entirely mineral cannot decay. It is earth itself, and is largely used in such places.

There is a very good preparation of canvas saturated with Trinidad asphalt for just such purposes as your correspondent, F. H. J., wants, imported, I think, by E. H. Wootton, of New York, and known as imported damp-course. It is flexible, will not crack, and appears to us to answer all requirements. Yours truly,

W. M. C.

A BOOK ON ETCHING.

NEW YORK, May 26, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you be kind enough to publish the title, publisher and price of some good work on etching, from which one could get the rudiments of the art? Yours truly, NEEDLE.

[LALANNE'S "*Treatise on Etching*," translated by Mr. S. R. Koehler and published by Estes & Lauriat, Boston. Price, $3.50. — EDS AMERICAN ARCHITECT.]

BOOKS ON THE FRENCH RENAISSANCE.

BUFFALO, N. Y., June 1, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you kindly send me a list of a few of the best and most fully-illustrated works on French Renaissance, with publisher's name? I do not care about works on the history of the style, or containing a great deal of descriptive matter, as I have that in other books, but for good illustrations of the best examples in the style named. If you can assist me, you will greatly oblige a subscriber. Yours truly, F. W. HUMBLE.

["*La Renaissance Monumentale en France*," from the reign of Charles VIII to Louis XIV, by A. Berty, 1867. 2 vols. 100 plates.

"*Monuments Historiques d'Architecture et de Sculpture*," from the beginning of the Renaissance to the Revolution. By César Daly, 1867. 2 vols. 204 plates.

"*La Renaissance en France*." By L. Palustre, 1827. Ladoux, publisher. — EDS. AMERICAN ARCHITECT.]

NOTES & CLIPPINGS

HOW TO ACT AT A FIRE. — I now purpose, in the most concise way possible, giving some simple directions how to act on the occurrence of fires. Fire requires air; therefore, on its appearance every effort should be made to exclude air — shut all doors and windows. By this means fire may be confined to a single room for a sufficient period to enable all the inmates to be aroused and escape; but if the doors and windows are thrown open, the fanning of the wind and the draught will instantly cause the flames to increase with extraordinary rapidity. It must never be forgotten that the most precious moments are at the commencement of a fire, and not a single second of time should be lost in tackling it. In a room, a table-cloth can be so used as to smother a large sheet of flame, and a cushion may serve to beat it out; a coat or anything similar may be used with an equally-successful result. The great point is presence of mind; calmness in danger, action guided by reason and thought. In all large houses buckets of water should be placed on every landing, a little salt being put into the water. Always endeavor to attack the bed of a fire: if you cannot extinguish a fire, shut the window, and be sure to shut the door when making good your retreat. A wet silk handkerchief tied over the eyes and nose will make breathing possible in the midst of much smoke, and a blanket wetted and wrapped round the body will enable a person to pass through a sheet of flame in comparative safety. Should a lady's dress catch fire, let the wearer at once lie down: rolling may extinguish the fire, but if not, anything (woollen preferred) wrapped tightly round will effect the desired purpose. A burn becomes less painful the moment air is excluded from it. For simple burns, oil or the white of egg can be used. One part of carbolic acid to six parts of olive oil is found to be invaluable in most cases, slight or severe, and the first layer of lint should not be removed till the cure is complete, but saturated by the application of fresh outer layers from time to time. Linen rag soaked in a

mixture of equal parts of lime-water and linseed oil also forms a good dressing. Common whiting is very good, applied wet and continually damped with a sponge. The St. John's Ambulance Association advise the following to restore breathing: To clear the throat, place the patient on the floor or ground with the face downwards, fold one of the arms so that the forehead may rest upon the forearm, in which position all fluids or smoke will more readily escape by the mouth, and the tongue itself will fall forward, leaving the entrance to the windpipe free. Assist this operation by wiping and cleansing the mouth. To excite breathing turn the patient well and instantly on the side, supporting his head on his forearm and excite the nostrils with snuff, hartshorn, and smelling-salts, or tickle the throat with a feather, etc., if they are at hand. Rub the chest and face warm, and dash cold water, or cold and hot water alternately on them. To initiate breathing, draw the tongue out and keep it out by means of an elastic band passing over it and round the chin. Replace the patient on his face, raising and supporting his chest well on a folded coat or other article of dress. Turn the body very gently on the side, and a little beyond, and then briskly back again onto the face, repeating these measures cautiously, efficiently, and perseveringly, about fifteen times to the minute, or once every four or five seconds, occasionally varying the side. On each occasion that the body is replaced on the face, make uniform but efficient pressure, with brisk movement on the back, between and below the shoulder-blades, or bones on each side, removing the pressure immediately before turning the body on the side. By placing the patient on the chest the weight of the body forces the air out; when turned on the side this pressure is removed, and air enters the chest. During the whole of the operation, let one person attend solely to the movements of the head and of the arm placed under it. — *A. W. C. Shean, before the Society of Arts.*

Charlemagne's Palace. — The whilom residence of Charlemagne, the Imperial Palace at Ingelheim, will soon be but a purely historical reminiscence. What is left of it in Nieder Ingelheim, near Bingen-on-the-Rhine, opposite the proud Germania Monument on the Niederwald, are the remains of the castle, which will be connected with the name of Charlemagne for all time to come, and in which Frederick I, Barbarossa, resided, and where Henry IV was declared to have forfeited the German Imperial Crown. During the Middle Ages the noble old castle was destroyed; frequent sieges and stormings left their traces, and finally the myrmidons of Louvois put an end to Ingelheim's splendor as they did to Heidelberg Castle, leaving mere ruins on the site of the ancient palace, which were carried off piecemeal. Its magnificent marble columns went to Paris, Mayence, Wiesbaden and Heidelberg. The last owner but one, Herr de Bary, of Rheimes, had the ruins levelled to the ground, and began to rebuild it anew; his death in 1875 stopped the work then and there. In April last the barren site was purchased by the burgomaster of Nieder Ingelheim and a contractor, by the name of Struth, who did their utmost to preserve the venerable remains — but in vain. The Prussian Ministry, to whom they applied, expressed regret at being unable to do anything for them, as the property was on Hessian territory; the Hessian Ministry likewise refused to entertain the idea of buying it. The two owners have finally decided to parcel out the land and sell it. *Sic transit gloria mundi!* — *American Register (Paris).*

The Dam at San Mateo, Cal. — A remarkable dam is about to be constructed by a water-company at the San Mateo Canyon, four miles from San Mateo, Cal., in order to form a reservoir. The canyon is very narrow and steep, and 15 feet below the bottom is a solid rock on which the foundation of the dam will rest. The structure will be 170 feet high, 175 feet wide at base, 20 feet at the top, and 700 feet in length. It will be the largest stone dam ever known to have been built. The dike will have a curvature of eighty feet, and the convex side will be upstream. The material will be a new sort of concrete composed of stones. The walls will be perfectly smooth. The reservoir that will be formed by it and the adjacent hills will be about eight miles in length and 150 feet deep in the deepest places. Its capacity will be about 32,000,000,000 gallons. The water will be conveyed by tunnels to the city of San Francisco. — *Boston Journal.*

The Forfeiture of Wages. — The Supreme Court in Philadelphia has decided an interesting contest on wages in the suit of Good *vs.* the Pottsville Iron and Steel Company. Good was engaged to work in the company's foundry without anything being said as to notice of quitting. At the end of a month he was required to sign a receipt for his wages in which it was agreed that if he left the company without giving 14 days' notice he should forfeit all wages then due. Shortly afterward he left without such notice, and was refused his wages. He sued and recovered them, but the Supreme Court now reverses the judgment, holding that he was not obliged to sign a receipt containing such a provision, and that he might have refused to sign and recovered all wages to that date; but that, having signed, a new contract was created by which he was bound. Judge Green says: "In large establishments where very great loss may be inflicted by a sudden and extensive strike of the men such a rule seems to be an entirely proper and reasonable one."

Ancient Relics at Sidon. — Additional despatches received at the State department from Consul Bissinger at Beirut, Syria, respecting the remarkable archæological discoveries at Sidon, state that the total number sarcophagi excavated is seventeen, found in seven distinct chambers. Beshara Effendi, civil engineer, is having a tunnel excavated for their removal to the seashore, whence they will be shipped to Constantinople. A shaft thirty-five feet square, discovered in the western chamber, led to a sarcophagus twenty-five feet below the surface with seven large rooms cut out of the solid rock. In a room adjoining the western chamber four sarcophagi were found. One of these, of pure white marble, highly polished and exquisitely sculptured, is ten feet six inches long, six feet nine inches wide, and five feet high, with a cover three feet higher. The roof is composed of tiles resembling leaves, and also shows rampant figures, crouching lions, human heads with double faces, and stags' heads with curved horns. Three of the sides of this sarcophagus are devoted to battle scenes and emblems of war — arrows, spears, bows and lions, with dead, dying, and wounded soldiers.

The fourth side represents a hunting scene. There are also panels with richly ornamented geometric figures. In one of the battle scenes there are prominent two nude figures of a man and woman. The color is still fresh, as if put on recently. There are scarlet cloaks, blue tunics and blood oozing from the wounded warriors. In the north room seven Egyptian sarcophagi were found richly carved. In the eastern chamber there were three sarcophagi, one plain and one lavish with exquisitely-carved sculpture. This is the famous so-called Greek Sarcophagus. It is surrounded by a porch of eighteen fluted Ionic columns and four Doric columns at the corners. Between each of the columns stands a beautiful girl representing "grief," all cut without a spot or blemish. Two sarcophagi were found in the south room, one of black marble, the other of white. Inside one of these was found a gold ring, a gold chain, and an alabaster vase. The others had been rifled of their contents without suffering any special injury. The local Turkish authorities are jealously guarding these valuable relics. It is only a question of time, Consul Bissinger says, when they will be photographed, to the delight of all archæologists and lovers of art.

TRADE SURVEYS

From incomplete building statistics gathered from ten large cities between Boston and St. Louis, coming down to June 1, it appears that, as against last year, there has been an increase in estimated expenditures of fifteen per cent. If it were practicable to supplement these inquiries with answers from the multitude of thriving industrial towns and villages contiguous to such centres as New York, Philadelphia, Chicago, St. Paul and Omaha, it would, without doubt, be shown that the increased constructive activity would reach from twenty to twenty-five per cent. High taxes, labor-control, dear land, and other causes have contributed to stimulate activity in smaller towns where land is cheaper, taxes lower, and employership less vexing. The tendency to industrial centralization, so far as capital is concerned, is offset largely by the tendency among smaller producers and manufacturers to seek new locations and surroundings. The indications of this tendency have been quite numerous within the past few weeks. Good sites in small places have been purchased at from one-half to one-tenth what smaller sites could be purchased at in larger cities, and where taxes would not exceed one-fourth. In these days of narrow and declining margins such items become important, and with some manufacturers become pivotal. Under a more enlightened system of railway management manufacturing interests will, as they already do in numerous instances, seek their natural economic level. All the conditions of trade are favorable. Within a week contracts for the delivery of one hundred thousand tons of steel-rails have been placed for delivery next winter at American mills, and contracts for about half that amount have been placed in foreign rail-mills. The movements of railroad builders are clouded. It seems probable that large contracts will be made with foreign makers at an early day, and also that home mills will, within the next sixty days, dispose of a very large part of their winter capacity at $38 to $39. The iron and steel makers generally, outside of rail and bridge iron makers are pursuing a cautious course. The Amalgamated Association have requested this week a ten per cent advance. In Eastern Pennsylvania a ten per cent reduction has been offered at a few mills, and if accepted will be offered by others. Outside of steel rails scarcely any business is being done in foreign markets. The coal production in anthracite, bituminous and block is in excess of last year, and especially in bituminous production is increasing steadily. New coal fields are being actively sought for and after by industrial capital, and especially so in the far West where hitherto the existence of large supplies of good coal has been doubted. These recent discoveries are being rapidly followed by developments and the projection of a number of small industrial enterprises, which naturally follow in the wake of railroad construction. In several of the minor industries healthy conditions exist. Lumber manufacturers' and dealers' distribution is progressing in all markets at an unprecedented rate, and prices hold up well. Bricks have been scarce in a few markets. Railroad ties are scarce. Building-material generally is abundant and even in price. The demand this season has given a stimulus that will increase the supply of nearly all kinds of building material. Nails barely hold their own, even under a powerful combination. Wrought-iron pipe is weakening slightly, and five to six hundred miles of pipe are now under contract. Locomotive builders have taken orders within ten days for very large freight engines. The car and bridge builders are extremely busy. Machinery of every description is wanted about as fast as it can be turned out, and at a half-dozen of the very large establishments orders cannot be placed except for delivery after August 15. In commercial and jobbing circles the remark is frequently made that business is slacking up. This, when looked into, means that the trades of the United States do not feel that it is necessary to rush three to six months' orders in ahead, through any possible scarcity in supplies. They have a well-founded faith that supply is equal to demand. It is true that in certain lines, such as carpetings, upholstery, etc., the next six months' requirements will be pretty generally ordered during the next four or six weeks; but this is the custom in those industries. Extraordinary machinery requirements are coming in. The machinery constructors (workmen) who for years have not ventured inside of a general organization have been in session all this week at Pittsburgh, Pa., encouraged by the increasing demand for their labor and the prospects of increasing pay. Agricultural-implement manufacturers and wagon-makers all over the West have done well, and that overdone industry is once more feeling the effects of agricultural prosperity. Very little dulness exists among wood-working machinery makers.

The summer season will bring out thousands of halting buyers who usually pay the highest prices as a reward for their extreme caution. Manufacturers generally feel they are reaping a minimum of reward on invested capital, and would be glad to see better things. The disposition to curtail production when it is shown to be necessary is manifest. Trade organization has averted much of the danger which has heretofore existed. Competition is no longer such a dreaded factor. Business men recognize the fraternity of interests which exist. Wage-workers, while occasionally running into vicious courses, are, on the whole, more conservative, as they are more wisely advised by their own chosen leaders. The determined course of Chicago employers is not lost on employers or workmen elsewhere.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, by TICKNOR & COMPANY, Boston, Mass. No. 599.

JUNE 18, 1887.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

THE Société Centrale des Architectes de Belgique is one of the most active and energetic bodies in the profession. Whatever it undertakes to do is done thoroughly, as well as with a certain forcibleness which attracts unusual attention. The last subject which it has taken under consideration is that of public competitions, and the results of its deliberations have been collected in a pamphlet, which has been issued for presentation, as the official expression of opinion of the Society, to municipal bodies, directors of hospitals, building committees of churches, and others interested in the matter from the point of view of those outside the profession. The pamphlet consists of two reports drawn up by committees of the Society, one on the utility of competitions in general, and the other on the best method for their organization, which have been adopted by the Society, and, as it is thought, show that a fair competition for public work is favorable to all interests concerned, but that it is of great importance that the competition should be carried out in accordance with the principles approved by the profession. In regard to the utility of such contests, the report calls to mind that they have been in use for many centuries, and cites the examples of the competition for the doors of the Baptistery at Florence, of that for the Cathedral in the same city, of that for the Cloth-Hall at Ypres, etc. In our own time a strong feeling seems to have grown up against them in Belgium, as in our own country, and the report examines in what seems to us a very instructive manner the main arguments against them.

THESE arguments may be divided into two classes, those which appeal to laymen, and those current in the profession. Among the former the most potent is perhaps that which represents the danger of exposing a community to the rashness and inexperience of young men, who, as those who use this argument assert, are the only ones in the profession who take part in competitions. "Architects of recognized position," say the volunteer advisers of the authorities who wish to build, "do not enter such contests. If you have a competition you will only become entangled with people that no one knows anything about, and you would do much better to employ at once old Mr. X., who designed the boiler-house for the State lunatic asylum, and who, having spent forty years at the carpenter's bench, must know everything about architecture." The building committee, or other persons in charge of the matter, reflecting that the competitions which they and their friends have previously managed did not seem to attract the leaders of the profession, fall in with this view, and the responsibility of spending a million or two of public money is entrusted to some pertinacious lobbyist, possessing no real qualifications or professional standing whatever. We know well enough in this country the public buildings designed on this system, either with or without the preliminary farce of a pretended competition, and the Belgian architects seem to have similar examples to point the moral of their report. We content ourselves, when we hear of public buildings which are falling to pieces so rapidly that fences are put around them to prevent people from getting in the way of the fragments, or of State-houses and hospitals which are put in charge of a commission almost as soon as they are finished, to see if they can be so altered as to make them fit for their intended purpose, with ascribing all this miserable inefficiency and stupidity in public work to the influence of democratic institutions, but our Belgian brethren take a more practical view, and attribute most of the evil to the circumstances which have prevented such work from being opened to the coöperation of men of real skill. "If competition for public buildings has been regularly organized," they ask, "would such structures ever have been erected as the City-Hall of Vilvorde, the Court-Houses of Dinant and Tournai, and many others which need not be mentioned?" In point of fact, they go on to say, the idea that architects of experience and reputation will not take part in competitions properly conducted is wholly groundless. In France, where, after a long struggle against the indifference of the public authorities, and the opposition of those interested in the existing state of things, the architects have succeeded in opening important public work on fair terms to the emulation of the profession, not only the most distinguished but the oldest architects participate regularly in them. Among the competitors for the rebuilding of the Hotel-de-Ville in Paris were M. Vaudremer, who was then forty-five years old, and had just completed his famous church of Montrouge; M. Ballu, fifty-six years old, the winner of the competition, who had already built three great churches; M. Baltard, sixty-seven, the architect of the Church of Saint-Augustin and the renowned Halles-Centrales; M. Magne, fifty-one, the architect of the theatre of the Vaudeville, the theatre of Angers, and two large churches, and many others of equal age and reputation. More recent competitions have attracted the best men in an equal degree, and the great public buildings of France, without exception, do honor to the country and the profession.

WITH regard to the effect of competitions properly conducted on the profession, the report speaks earnestly and well. Apart from the reputation to be gained by success in a noted contest, the opportunity of comparing his best work with that of others is something that a true artist, desirous of improving himself, would not willingly forego. A painter or sculptor who refuses to exhibit with others, and shows his pictures or statues by themselves, generally gets the reputation among people of sense of being a charlatan; and architects, perhaps least of all, can afford to neglect the most useful means for correcting their errors and gaining fresh ideas, through the ordeal of well-conducted competition. It is true that much time, money and trouble must be thrown away by the unsuccessful competitors, but this, which is the principal objection to architectural competitions, may be in great part obviated by the double trials which are now becoming common, and indirectly the expenditure is to a certain extent made up by the interest excited among the public by a competition, which is apt to extend from the particular building under consideration to architecture in general, of course with final advantage to those who practice the art with skill. After the competition for the Exchange at Amsterdam, the drawings were exhibited, and more than twenty-five thousand persons came to see them. Two-thirds of the number had probably never seen an architectural drawing before, and the sight of this collection may have formed their entire education in architectural criticism, but it was certainly much better than nothing, and many an architect will owe a client to the impression made by the exhibition.

THE BRITISH ARCHITECT gives a description of the means adopted recently for lowering a bridge without interrupting the traffic over it, which is worth remembering for

future use. The new approach bridge, over the River Irwell, leading to the Exchange Station at Manchester, had been built at such a grade as to make it dangerous to drive over it in some circumstances, and the railway company decided to lower one end of it. The structure was supported by five main box-girders, about one hundred and sixty feet in span, joined together by cross-girders. The distance through which the end was to be lowered was about sixteen inches. Piles were first driven in the river-bed, and under the end of each girder was placed a cast-iron cylinder, eight inches in diameter, and of metal three inches thick, supported by the piles. The bottom of the cylinders was made conical, ending in a short, open tube, through which was inserted, laterally, a steel bar, two inches in diameter, and drilled with a hole, exactly like the plug of an ordinary water-faucet. The cylinders were then filled nearly to the top with dry sand, and oak posts set in, resting on top of the sand, and wedged tightly up to the under side of the girders. When all was ready, the steel plugs were turned, and the sand allowed to flow out. In five minutes the girders had been lowered an inch, and the flow was then stopped, to see if any signs of undue strain appeared in the joints of the bridge. As none were to be seen, the sand was again allowed to run out; and, with frequent stops for new examinations, the operation was continued for five hours, when the bridge had reached its final position, without any interruption to traffic, or any visible strain in any part.

THE *Philadelphia Press* gives the first clear account that we have seen of the remarkable series of strikes and boycotts which have nearly made an end of the business of an unfortunate carpet manufacturer in New York, who has never done anything inconsistent with Union rules, and has obeyed to the best of his ability the orders imposed upon him by various executive committees. It seems that Mr. Higgins's factory employs members of two of the New York District Assemblies of the Knights of Labor. Not long ago it was necessary for him to discharge some of his operatives, and, as it happened, all those selected as being most easily spared belonged to Assembly No. 126. The Executive Committee of this Assembly promptly ordered the factory to be struck until the discharged men were reinstated, and most of the operatives dropped their work accordingly. Those who remained belonged to Assembly No. 49, the Executive Committee of which could not brook any interference with its members from another committee, and, therefore, ordered its own men to remain in their places. Obviously, a factory could not run with only one-tenth of its hands, and as the Executive Committee of "49" threatened to call out its men if any negotiations were entered into with the usurping "126," and "126" refused to listen to any terms so long as the authority of "49" was recognized, Mr. Higgins found himself in a lamentable condition. He finally plucked up courage, and negotiated successfully with "126" for the return of the main body of his men. For a time "49" appeared to acquiesce, but its managers, as it appeared, only nursed their revenge until a favorable opportunity. This soon presented itself. Another strike in Assembly 49 gave a pretext for annoying people by wholesale by calling out its men to "show sympathy," and Mr. Higgins's engineers, who belonged to this Assembly, were ordered out. Mr. Higgins tried to adjust the matter, but was told that he could not have his engineers back until he broke off his agreement with "126." He had already had enough of fighting with "126," and refused; and "126" procured engineers for him who did not belong to Assembly 49, and notified him that if he ever took back the "49" engineers his factory would be struck. The next step of "49" was to induce more carpet-weavers to join its ranks. They were taken in, one by one, and when enough of Mr. Higgins's men had joined to make their loss a serious matter, they were suddenly ordered out. The distracted Mr. Higgins tried to negotiate with both parties, but was not regarded by either of the combatants, and at last "49," overcome by numbers, withdrew from the fight, taking its men with it, and "126" supplied their places. On most battle-fields, after the combatants on one side are all dead, gentle peace reigns for a time; but with the Knights of Labor it is not so. No sooner had "49" abandoned the contest than the General Executive Board of the "Colossal Organization" stepped in, and proceeded to deal smashing blows at "126," using Mr. Higgins as a club. The entire Assembly No. 126, containing thousands of innocent men and women who had never seen a carpet-loom, was expelled from the "Colossal Organization," simply because its Executive Committee had assumed too much authority; and a villainous circular was officially promulgated throughout the country, warning all members of the Knights of Labor not to have anything to do with the Higgins carpets, on the ground that they were "not well made"; the truth being simply that they were made by working men and women whom the tyrants of the order wished to injure, so as to reach over their heads, certain officials who were not servile enough to suit their taste. The selfish and impudent men who push themselves to the front among the Knights of Labor have to answer for many cruel schemes for magnifying their own importance at the expense of the poor and uncomplaining people whom they rule, but no one has been more brutal than this, which is due to the highest authority in the "Colossal Organization." We trust that the courts will take speedy action in regard to the circular, and attach the funds of the Order to repay the losses which Mr. Higgins and his operatives may suffer on account of it. There can be no question of the justice of making the money in the hands of such conspirators liable for the damage which they cause; and a few test cases would make it dangerous business for the Executive Boards to sacrifice truth and decency to their private malice.

A SINGULAR accident took place not long ago in Germany, recalling, in some respects, the fall of the Bussey bridge in Massachusetts. A suspension bridge was built in 1851 across the River Ostravitza, between Ostrau in Moravia, and its suburb, in Silesia. Instead of ropes, the bridge was sustained by four chains, composed of what we should call eye-bars, each link containing six eye-bars, so that each pin-connection passed through twelve eyes. This must have been originally an excellent arrangement, such chains being flexible enough for their purpose, and not liable to some of the obscure defects of ropes, while they would be much more easily inspected than wire cables. In fact, inspection of a certain sort seems to have been regularly given them, and two years ago the municipal officers, who were naturally anxious about the condition of an iron bridge thirty-four years old, ordered a special examination by experts. A month later they received notice that the bridge had been inspected in every part, and had been ascertained to be in good condition, and was entirely safe. Reassured by this "inconceivable report," as *Le Genie Civil* well calls it, the town authorities allowed it to be freely used, and on at least one occasion this spring, there were more than three hundred persons on it at once. A few days later, when two carriages, ten persons, and a file of cavalry soldiers, sixteen in all, were on the bridge, the suspending chains on one side broke, letting the bridge fall, and killing or wounding a large part of the people on it. There is some reason to suppose that, as in the case of the fall of the famous suspension bridge at Angers, the final strain may have been due to the vibration caused by the measured march of the cavalry, but horses do not often keep step with mathematical precision, and the condition of the bridge, as shown after the accident, was quite bad enough to account for the catastrophe independent of vibrations. Instead of the "good condition" in which the "experts" reported that they had found the ironwork, eleven out of the twelve eye-bars composing the broken double chain were found to have lost five-sixths of their substance by rust; the metallic section of each eye-bar remaining being, on an average, one-tenth of an inch thick; while the twelfth member of the group was found, completely rusted, and covered with dust, in the spot where it had lodged when it dropped, long before, from its place. Of course, a wrought-iron structure, even if originally designed with a factor of safety much larger than usual, would be in imminent danger of falling by its own weight when rust had consumed more than five-sixths of its substance, and a simple calculation showed that the strain on the sound metal at the time of the fall was more than the breaking-strain of good wrought-iron; so that the real wonder is that the bridge stayed up so long. The most serious corrosion, strange to say, was found to be under cover, where the chains were anchored on the land side in a chamber of masonry under the parapet; but it seems that foul water from the street had penetrated into this chamber, and the oxidation of the ammonical fumes may have produced acids which would act very powerfully on iron.

BUILDING ACCIDENTS.—I.

TALL CHIMNEY-SHAFT ACCIDENTS.



INITIAL 15 CENTURY. AFTER LAST

ACCIDENTS to tall chimney-shafts, even when unaccompanied by loss of life, must always be a source of much trouble, loss of business, and great inconvenience; and any one interested in chimney construction will naturally be led to inquire into their cause and prevention. When acc mpanied by loss of life it becomes imperative that the subject should receive most serious consideration.

With the foregoing in view and believing that more can often be learned from failures than successes the authors have, for many years taken notes respecting, and inquired into accidents of all descriptions in connection with tall chimney-shafts.

Accidents have arisen from the following causes:

1. Bad foundations.
2. Improper designs, and indifferent materials and workmanship.
3. Wind-pressure.
4. Lightning.
5. Large overhanging caps.
6. Oscillations.

In some cases two or more of these causes have combined to overthrow the structure. There are also

7. Accidents to "steeple-jacks" and workmen.

It will be seen, from the information obtained after the accidents, in many instances the shafts were built without the careful consideration and special knowledge which are necessary in designing such structures, and it cannot be too widely known that shafts are not ordinary erections, the failure of which will necessitate *only* a rebuilding. Unstable shafts are impending dangers, and may be imminent death to many. In some cases given it will be noted that the owners or proprietors have considered themselves fully capable of designing tall shafts and have only called in an architect or engineer at the last hour, when they lost all confidence in their own ability, and the defective structure was nearly completed.

I. BAD FOUNDATIONS.

The first instance the authors intend giving, being probably the worst of its kind known, forms almost a typical chimney, so far as being an example of the dangers of bad foundation and improper design.

The Newlands Mill chimney, Bradford, built 1862–3, fell down December 28, 1882, killing fifty-four persons and destroying property valued at £20,000. The proprietors also had to pay damages amounting to £2,500 to the sufferers through this disaster.

The proprietors of the mill in 1862, being desirous of erecting a chimney, requested a builder to give a tender. There were no plans or specifications prepared, but reference was made to other chimneys built for the same proprietor. The following formed the basis of the tender: Chimney to be two hundred and forty feet high from ground-line, with octagonal exterior faced with stone and ornamented by panelling; to have circular flue nine feet diameter, base twenty-four feet square, with two courses of footings twelve inches thick, the first twenty-eight feet, the second twenty-four feet square; to rest on a bed of good concrete thirty-two-and-a-half feet square by two-and-a-half feet thick. The foundation for this chimney was prepared by the proprietors, and was on the site of an old coal-shaft; this was partly filled up with lime-concrete, forming a central pillar eight-and-one-half feet diameter, and around were constructed four other shafts, each six feet in diameter, also of concrete, the old surroundings being carefully packed with stones and oak wedges.

The chimney which was built with stone facings outside, brick lining inside, and backing in between the two, was commenced in July, 1862, and continued until the middle of December; the building was then suspended, being over one hundred and twenty feet high. The work recommenced February 28, 1863. Through-stones were built in about every three feet in circumference and about two-and-one-quarter feet apart vertically. The erection was continued to the 7th June, the chimney having reached two hundred and ten feet high.

On the evening of June 7th the chimney was left plumb. On the following day, the 8th, it was found to be bulged on one side and hollow on the other. About fifty-four feet from the ground-line a course of stones was cut out on the side opposite to the canting over, and the space was filled up with stones one-half inch less in thickness. This operation was continued nearly half-way round, iron wedges being used on top of the thinner stones to support the masonry. Upon withdrawing these iron wedges the workmen could hear the through-stones break. The first cut did not have the desired effect, and a second was made about two feet above the first, with the same results as to breaking the "throughs." The shaft was after this declared to be perpendicular.

Three years after completion the chimney was found to be cracked and broken on the side opposite to the cuts. This was repaired. About 1872, further cracks were noticed and likewise repaired.

In October, 1882, the tenants of the mill became uneasy, further indications of cracking having appeared, which, in December, developed into bulges. Upon examination it was decided to take out the bulges and repair the outer casing, it being the general opinion the latter was alone at fault. Difficulty was experienced in this, and the attempt to rectify the bulge failed.

On the 26th of December small portions of the outer casing fell, and on the 27th a large piece fell, breaking down the scaffold used for repairs. On the night of the 27th the wind blew half a gale, or about sixteen pounds per foot superficial. On the following morning, December 28, more of the outer casing fell, and at a few minutes past eight o'clock, A. M., the chimney began to settle, bursting out stones and lime where the shaft had been cut. This continued for a few seconds, then the upper portions of the chimney fell in a south-east direction, with the fatal results as stated at the commencement of this description.

From the foregoing account it is evident the chimney was badly designed, as well as built on a faulty foundation. The site selected, an old coal-pit shaft, surrounded by old workings was almost the worst one can conceive, and as to care being taken to pack them with stones and oak wedges, no amount of care could make such old workings solid. The structure was not homogeneous, nor could the introduction of "through" stones, one to the yard, make it so. Common brick being used inside, good ashlar wall-stones outside, the space within filled with backing, good screened lime used for the inside lining and outside facing, unscreened lime used for the backing, constituted three different materials of varying crushing strengths, and the whole history of this ill-fated structure constitutes a chapter of warnings in the annals of chimney-building.

An ingenious devi e for building a chimney-shaft for the Truro Gas Works, Cornwall, on a faulty foundation, was given in a paper read before the Architectural Association, England, in 1886. The site was not far from the banks of an estuary, and the foundation-bed unequal and uncertain. The chimney had been twice built and twice it had failed. The builder then made himself responsible for its secure erection; he judged that if it must sink at all it ought to be made, or, at all events allowed to sink equally; he therefore had a large block of granite of several tons weight roughly shaped into a pyramidal form. First of all, this block was embedded point downwards, and on its upturned base was gathered-out the walling to the extent required. The shaft was built on this foundation, and although it subsided eighteen inches it sank so regularly that it kept its erect position as nearly as possible.

Bingley, near Bradford. This chimney, which was built at a cost of £2,000, was found, a few years since, to be four feet six inches out of perpendicular. The inclination was due to the foundations having settled on one side. Some local people were consulted and advised that excavations should be made under the foundations at the opposite side, until the chimney settled there to the same extent, and so brought itself back to the perpendicular. A well was actually dug beneath the higher side of the shaft and supplied with water to favor the yielding of the rigid part of the foundation. It fortunately happened before the water had time to accomplish its dangerous work, a London firm was called in to advise, who promptly filled in the well that had been excavated with brickwork and concrete. The bottom of the shaft was then cut half through, on the side where no settlement had taken place, by removing three courses of the brickwork. As these courses were cut away strong iron jack-screws were inserted to sustain the unsupported mass of brickwork. The jacks were put in one after the other, a few inches apart, as the brickwork was cut out, and each one was adjusted by its regulating screw. When the entire gap had been formed, the jacks were slowly and gradually shortened. When the shaft had very nearly settled back into its original vertical position the portions which lay between the jacks were filled in with solid masonry, the jacks were then one after the other removed, and masonry also put in their places. The work was thus successfully accomplished, and the chimney now stands upright.

Berle Chemical Works, East Jarrow. In February, 1875, during a strong gale, a large chimney connected with these works was blown down. Three men were at work eighty yards from the shaft; one was killed on the spot; a second died afterwards, and the third man was slightly injured. The chimney fell on a building, doing damage to the amount of £3,000. The jury, in their verdict upon the death of the two men, expressed an opinion that the accident was due to the defective and insufficient foundation on which the shaft was built.

II. IMPROPER DESIGN, INDIFFERENT MATERIALS AND WORKMANSHIP.

Collapse of a Chimney-shaft at the Elton Vale Bleach-Works, Bury, Lancashire.—On Wednesday, January 23, 1884, about one P. M., during a strong gale of wind, the top portion of chimney-shaft fell onto the roof, wrecked the building, and killed three of the workwomen.

The shaft must have been erected many years, as the proverbial "oldest inhabitant" could not remember it being built, but the following particulars were given at the inquest. The original height was ninety feet by seven feet two inches square outside, and three

feet four inches inside at base, the top was nine-inch brickwork, and the outlet one foot eight inches. In June, 1870, it was partly pulled down and rebuilt to a height of one hundred and five feet, and the opening at top made larger by building to a less batter, so as to provide a better draught to boiler fires for increased steam power. No architect was employed. In December, 1882, an iron belt was put round the top because the blocking-course had cracked, also the shaft being out of perpendicular and leaning over the building, it was straightened by taking out bricks from one side, and replacing them by thinner ones. The work was done in frosty weather, and after pointing up a crack ∠ irons were fixed at the corners, and five wrought-iron bands were put round the shaft. The "steeple-jack" who did the work told the proprietor it would stand, as he had done all he could to it. In answer to a juryman, this workman said, "Christmas was a good time to mend chimneys as the frost did not get into the mortar because the chimneys were always warm!"

An architect called in after the accident to report on the case for the guidance of the jurymen stated that the walls of the shaft were said to be built of nine-inch brickwork with nine-inch stonework outside, and little attempt was made to obtain a proper bond. The base was quite inadequate to the height of the shaft: he would have built it ten feet at base with a two-foot batter. Increasing the height was the primary cause of the accident. The pointing in the stonework showed there had been considerable expansion on account of intense heat, yet the inside brickwork was not calcined or damaged, and probably had been at some recent period renewed.

The cause of this accident can be summed up in a few lines. Fifteen feet were added to a shaft built of brick and stone imperfectly bonded and without due consideration of the sufficiency of the base. In this condition it stood upwards of twelve years, and gave warning of the coming collapse by leaning over the building. It was brought back to the perpendicular by reducing the thickness of one course of brickwork, ∠-irons being fixed at the corners and bound round with iron hoops. In this crippled condition it stood two years, but overweighted, imperfectly bonded, and with insufficiency of base, it was at the mercy of the wind, which finally caused its destruction.

It may be noted that a contract had been signed for building a new shaft about eighty yards from the old one on the very day the accident occurred.

At the Liverpool summer assizes an action for damages was brought against the proprietor of the works, by the father of one of the victims. A "steeple-jack" gave evidence for plaintiff, and stated that although it was a common occurrence to straighten chimney-shafts as this had been, yet in his opinion they were always weakened thereby. For the defence the main contention was that the fall of the shaft was solely attributable to the extraordinary gale experienced on the day of the accident. The jury found for the plaintiff, damages £40.

Fall of a Mill Chimney at Dye Works, Windhill, Shipley; eighty-seven feet high, seven and one-half feet square at base.—In 1882 this shaft was thought to be in an unsafe condition, and the Local Board had it examined; it was then reported to be quite safe. The shaft had, for some time, been out of plumb, and a fortnight before the accident, owing to complaints as to its dangerous condition, an architect examined the chimney and reported to the Local Board that it ought to be taken down.

The main portion of the shaft fell on the 27th of July, 1885, across the engine-house and a part of the works, destroying buildings and machinery used in dyeing, etc., and doing damage to the extent of £600. Eye-witnesses stated it fell in one mass and only broke when it came into contact with the buildings.

Fortunately, at the time of the accident the workpeople were having a holiday, or serious loss of life would have resulted.

In this case ample warning had evidently been given by the structure itself as to its unsound condition, and these indications should not have remained unheeded for three years until the chimney fell.

Fall of a Cavity Chimney in Oldham; one Man Killed.— This accident occurred in May, 1873, at the Osborn Mills of Featherstall Road. The shaft was one hundred and sixty-five feet high, sixteen feet in diameter at base, and seven and one-half feet at top, and leaned over considerably on one side. The owners entered into a contract with two brothers, who were chimney-builders, to "saw" the chimney. Observing that instead of sawing out some of the mortar-joints they removed a course of brickwork at about one-third of the height from ground-line on the higher side, and put in place thereof wedges of iron and wood; the owners remonstrated with them. One of the brothers at the bottom of the shaft assured them that taking out a course of bricks was as safe as sawing the mortar-joints, and took one of the owners to some rising ground to observe the safety, when, as if in ridicule of his assertion, the chimney toppled over bodily, except about thirty feet at the base, and the man at work on the scaffold was buried in the ruins.

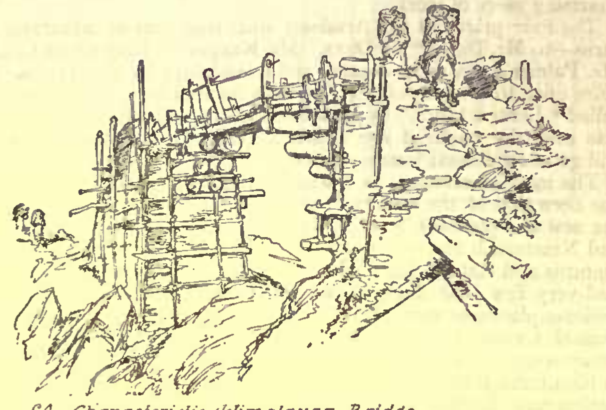
An experienced builder, at the inquest, stated he was of opinion the chimney was built in a faulty manner. The materials were inferior, many of the bricks being soft, and the mortar improperly mixed, consisting too largely of sand. The fall of the chimney he attributed solely to the conduct of the men themselves in cutting so large an aperture through the brickwork and needlessly removing a course of bricks.

In straightening chimney-shafts, recourse has often been had to the removal of a course of brickwork for half the diameter and the insertion of thinner bricks, and the straightening has been successful, but such an operation requires caution, and the thinner bricks should be built in as the larger ones are removed, the original thickness being made up with iron wedges to be gradually withdrawn. These precautions were not, however, taken in this case, and one man paid the penalty with his life.

R. M. AND F. J. BANCROFT.

[To be continued.]

PICTURES OF THE SEASON IN NEW YORK.[1]—IV.



A Characteristic Himalayan Bridge after sketch by Wm Simpson

TWO more large general exhibitions of American works have been opened since the opening of the Academy. The Metropolitan Museum has shown its newly-acquired treasures; and minor collections and sales have been so numerous that it was hard to see them all, and still harder now to remember them.

Mr. Vedder exhibited a roomful of pictures and drawings, the latter including the full series of designs published last winter as illustrations to Omar Kayyám's verses. These appeared to better advantage, of course, than in the reproductions, but neither in them nor in the paintings did it seem to me that true imaginative strength or a really-accomplished kind of technique was revealed. And the color in some of the paintings was rather harsh and crude, though in others—notably in certain Italian landscapes—it was agreeably harmonious. In short, it was proved once more that Mr. Vedder's chief talent lies in the mastery of decorative effects of line. Sometimes these effects are so used as to produce a strongly-impressive pictorial result, as, for instance, in the picture of the "Fates" (which is an enlargement of one of the Kayyám designs) where his beautiful swirls and spirals are well in place as composing the fabric which the sisters are weaving. But in the rendering of deeper dramatic intentions through attitude and facial expression Mr. Vedder is not always successful; and though the dignity and seriousness of his work are always delightful, one is often distressed by his lack of power fully to reveal the intention one feels must have lain behind his result.

At the public sale of the artistic effects of the late Asher B. Durand—the Nestor of American painting and engraving—some eighty pictures and studies sold for about $9,000. (Since Mr. Durand's death, but one survivor remains of the original founders of the Academy of Design). A large collection of American pictures by different artists was also sold not long ago, attracted much attention from the public, and brought very fair prices. Thirty-thousand dollars' worth of pictures were sold at the Academy exhibition; and the new Museum collection also helps to prove the increase of our interest in native products.

When this collection was actually seen, it was found to contain a much greater number of recent acquisitions than had been described in advance. Not only the "Horse Fair" represented the Stewart collection, but also Meissonier's large "1807," given by Judge Hilton, and Piloty's "Thusnelda," presented by Mr. Hilton, Jr. A fine large Détaille, the "Battle of Champigny," had also been given by Judge Hilton, after having for a number of years formed part of his own collection, and Mr. Seney had added eight pictures to the ten he had recently presented. Many of his gifts are American works, and one of them is Carl Marr's quite delightful "Gossips," and two others, the late Mr. Fuller's "Nydia" and "And She was a Witch." Mr. Schaus sent Lhermitte's large "Vintage," and altogether the gifts of this one year, without including the Wolfe pictures, have made the Museum's collection a truly interesting and valuable one, as regards both American and foreign pictures. Infinite gratitude is due to those public-spirited citizens who have worked towards this result, and many congratulations upon the good sense and the good taste which, in almost every case, have inspired their selection of gifts.

The most conspicuous recent sales of foreign pictures have been those of the collection of Mr. Probasco of Cincinnati and of a motley assortment of French pictures—most of them good ones—brought over by M. Durand-Ruel. Even the Impressionist pictures in the last-named collection found ready purchasers though not at very high prices. The Probasco pictures as a whole were not so good as rumor

[1] Continued from page 196, No. 591.

had led us to expect, including a large percentage of dismal Düsseldorf products. But they also included certain very fine examples of the great French landscape painters, a beautiful Couture, and a charming large picture by Isabey, a painter rarely represented in American galleries. This was called, if I remember, "Love's Messengers," and showed three young women in a wood reading a letter brought by some cupids who hovered above them. It was a curious intermixture of fantasy and reality but a most delightful one, and as far as color and handling went an extremely individual as well as charming piece of work.

The four prizes at the Academy went this year to admirable pictures—to Mr. Dewing's "Days," Mr. Kappes's "Buckwheat Cakes," Mr. Palmer's winter landscape, and a landscape by Mr. Tryon. The prize open to women painters only was secured by a creditable figure called "Lenten Lilies," by Mrs. Richardson. Mr. Kappes, however, was over the required age and so returned his prize-money which will go to swell next year's amount.

The most interesting, as a whole, of the three spring exhibitions has been that of the Society of American Artists, which was held in the new and pleasant Yandell Gallery on the corner of Fifth Avenue and Nineteenth Street. It contained but one hundred and forty-eight pictures and statues, but among these were many of great excellence and very few that did not have at least the quality of interest. Commonplaceness were almost entirely excluded, and though certain examples were studies or sketches rather than pictures, and certain others were eccentric rather than original, and a few were stronger in intentions than in results, the general impression left by the collection was that our younger men are an extremely clever band of painters and that many of them are true, conscientious and able artists too. The portraits claimed, perhaps, one's first attention. Mr. LaFarge sent a beautiful study of a woman reading — painted many years ago, but none the less welcome on that account; Mr. Eaton, a beautiful, dignified, admirably posed, colored and handled portrait of Mrs. R. W. Gilder; and Mr. Dewing a small half-length of Mrs. Stanford White that was a veritable gem in feeling and in treatment and was appropriately set in a wide lace-like frame whose exquisite design clearly revealed Mr. White's own touch. Mr. Bunker's large portrait of a lady had no decorative charm but was a thoroughly successful essay of that deeper sort which aims at interpreting the sitter's inner nature as well as her mere superficial aspect. Mr. Chase's large full-length of a lady in walking dress, on the other hand, was an impression merely — a glimpse of a woman rather than a portrait, but a most vivid and vital and cleverly-treated one. His portrait of his sister — a child in a white dress — was more "serious" and was delightful in color, in sentiment and in drawing. Mr. Brandegee, Mr. Cox, Mr. Eakins, Mr. Rice, Mr. Tarbell and M. Rajon also sent excellent portraits, the last-named being in pastel. And Mr. Alden Weir's name may close my incomplete list. The girl's head he contributed showed even more than his usual strength, individuality and charm of sentiment, and all the beauty which his method has when at its very best.

Figure-subjects were not very numerous but some of them were extremely good. Mr. Wyatt Eaton sent a delicious little nude figure, and Mr. Thayer a life-size one that was interesting, decorative and in parts beautifully painted. Mr. LaFarge exhibited a little picture of the Lady of Shallot floating down the river in her boat — full of tender sentiment but tainted by no touch of sentimentality, and, of course, a jewel for rich and lovely color. Mr. Dewing's "Tobit and the Angel" had an element of strangeness which to many eyes made it seem a little fantastic; but it was extraordinarily unconventional, dignified and impressive in composition, and, to my mind, sincere as well as individual in feeling. Mr. Brush's "Aztec Sculptor" was an agreeable and accomplished piece of work, very good in color. And Mr. William S. Allen's "Five O'Clock" was a small "impressionist" picture of extraordinary quality — marvelously harmonious in tone yet rich and strong in color, and singularly truthful in atmosphere and perspective. It was a triumph in its way, but the way was one which the trained eye of an artist was quicker to appreciate than the hasty glance of the average visitor. The best still-life paintings in the room were Mr. Carlsen's — things so good in color and so extremely good in technique that one doubly regretted the lack of that skill in composition which was needed to make them thoroughly successful as pictures properly so called. The "Roses" of Mr. Thayer and the "Azaleas" of Miss Hecker seemed to me the best flower-paintings, excepting, of course, Mr. LaFarge's incomparable "Water-Lilies."

Landscapes were numerous and many of them very individual as well as good. Mr. Ryder's singularly poetical and variable talent was shown at its very best in his "Moonlight." The advance which Mr. Dewey has made of recent years was shown in his very successful "Lowlands" — which, by the way, was the landscape chosen by the Committee on Admissions to receive the newly-founded annual Webb prize. Mr. Allen, Mr. Cox, Mr. Carlsen, Mr. Chase, Mr. Coffin, Mr. Davis, Mr. Harry Eaton, Mr. Evans, Mr. Fowler, Mr. Minor, Mr. Teggin and Mr. Tryon — these are but some among the names which deserve citation. But I can speak in detail of only two or three additional works of exceptional interest. One of them was Mr. Ochtman's brilliant yet harmonious autumn landscape; two others were admirable impressionistic studies by Mr. Twachtman — who, one will remember, was an impressionist in Munich and America long before the Frenchmen made the term familiar; still another was Mr. Homer Martin's large and poetical "Lake Ontario"; and perhaps the most remarkable of them all was Mr. Walter Palmer's "Early Snow." I have already spoken of Mr. Palmer's winter landscape which took one of the Academy prizes; but this seemed to me even more individual and even better. Showing the margin of a river overhung by a high bank with thinly-planted pines and a far-off view of the opposite thickly-wooded bank — the distance in full sunlight and the foreground in flickering sun and shadow — it was a marvellous transcript of reality and yet a very artistic work of art. If it had a fault it was lack of any especial beauty in composition, the scene being such as one might see on any shore, not such as any artist would naturally have been impelled to paint for any peculiar felicity of line. But this fault — which to a thorough-going realist would probably seem itself a virtue — was atoned for a hundredfold by the brilliancy and truth with which light, color and atmosphere had been rendered. Only the French Impressionists, it seemed to me, had secured so strong, faithful and resplendent a result; and this work was better than theirs for it had the qualities which almost all their work lacks — reticence of manner, charm as distinct from strength of treatment, and truth to detail (comparatively speaking) as well as to the broadest general facts. One wondered last year whether the same things that the Impressionists had done with no detail and a very disagreeable sort of technique could ever be done with more detail and with a manner of painting which should be pleasant to look upon. In this picture we seemed to find the answer.

And I may anticipate my report of the current Prize-Fund exhibition in so far as to say that there again Mr. Palmer shows us a similar success in a small picture of a forest glade, thinly planted with young trees, through which the sunlight falls on snow. Simpler than either of the others in theme, this picture is perhaps still more remarkable in its rendering of the chosen effect. I am not in the least afraid to say that it is the most absolutely truthful, the most vivid, striking and wholly realistic painting of sun on snow I have ever seen from any hand, ancient or modern; and yet it has no eccentricity of manner, no lack of charm, no sign of striving for mere effectiveness, no exaggeration of one quality at the expense of others. It is so simple that it looks as though any one might do it, yet the longer one looks at it the more one realizes that no one has ever done anything like it before. The Frenchmen, I repeat, are often as brilliant and true, but, so far as I know their work, not one of them has yet got brilliancy and truth with so artistic a reticence of mood and so artistic a charm and completeness of manner. As Mr. Palmer had already painted for many years but never before had painted like this, he was doubtless helped towards his new path by the influence of last year's Impressionist exhibition. But even if this be true there is no reason why the adjective "original" should be denied to his results. Surely it is true originality to learn a lesson from some one else and then put its teachings into still more perfect shape.

Only $4,000 were subscribed to the Prize Fund of this year for the exhibition annually held under the management of the American Art Association. Therefore only two prizes could be awarded — that is to say only two pictures could be purchased for public institutions — as against four last season, and therefore one doubly regrets that these two should not have been more wisely bestowed by the anonymous and somewhat mysterious committee on awards. They went to two landscapes — a good one by Mr. Gay and a poor and rather meretriciously-pretty one by Mr. Davis who has exhibited far better works during the past year. Several landscapes hang on the walls which I think "a good judge" would prefer to either of them, and several figure compositions also. And at least one large still-life — by Mr. Alden Weir — infinitely better deserved selection. Of Mr. Palmer's landscape I have already spoken; but of the others which were good I have no space to speak since more figure-paintings claim attention in this exhibition than was the case with either of the others.

Prominent among them is a vigorous and vivid canvas with many figures by Mr. Robert Blum called "Venetian Lace Makers." It is not very often we see so animated a scene so vivaciously transferred to canvas; and the work is far more serious in quality than is always the case where vivacity is the first thing to strike the eye. The color is strong, yet sober, and the difficult illumination well managed; and each of the figures is as thoroughly well individualized as though it had been an isolated portrait, yet each keeps its place and none is so emphasized as to hurt the unity of the composition as a whole. For once we feel as though Mr. Blum had done his talent full justice; — sometimes in the past he has been so facile and brilliant as to indicate rather than convincingly prove his possession of really sturdy artistic qualities.

Mr. Ulrich's "Artist" is an interesting work though at once less ambitious and less thoroughly successful, it seemed to me, than his essays of the past year or two. Mr. Albert Ryder's "Shepherdess" (which perhaps I ought to have classed among the landscapes) is enchanting; but his "Flying Dutchman" is so fantastic that it will hardly be valued except by those who can dispense with form almost altogether if they are given a rich and singular chord of color. Mr. Rosenberg's row of old women in church is an admirable piece of work, simply "an academy" as far as idea and composition are concerned but better than the average "academy" in its expression of individual character. Near it hangs a large picture of French washerwomen, at their work, by Miss Amanda Brewster, which, when known as the work of a very young artist who has but recently turned from

landscape to figure-painting, produces a very strong and promising impression. Certainly it is not "an academy" or the product of anything but honest, individual observation of nature. Two or three of the figures are most admirably life-like and none fall far below the level of the best. The color, in which blues predominate, is strong yet harmonious: the background — a glimpse of a village street — is charmingly treated; and all the picture lacks to make it thoroughly successful is a more dominant centre of interest than it possesses. Composition in the sense of grace and harmony of line is a virtue for which the modern schools care far too little. But even if it may be left out of an artist's calculations, composition in the sense of concentration of interest — the selection and emphasis of one figure or motive of some sort which shall be the key-note of the whole, the dominant upon which all else depends and towards which all else leads up — composition in this sense, no one can afford to neglect if the making of a *true picture* be his aim. But it seems unfair to criticise anything in a work like this — so youthful yet so full of the prime virtues of sincerity, earnestness and technical intelligence. When a young student who two or three years ago painted nothing but little golden-hued bits of landscape suddenly appears with a picture of this sort and this quality, we feel that there is surely a future in store for her.

Mr. Millet sends two compositions with small figures, one of which — "A Difficult Duet" — is very charming in motive and very accomplished in treatment, but neither of them, I think, equals his "Cozy Corner" of last season — now, fortunately, among the Museum's new treasures. Mr. Childe Hassam is no longer true to Boston streets but is still true to his love for streets in general; and his Parisian views have all the grace of his earlier essays with a great increase of force, coloristic variety and dramatic feeling. The monotony of his former work has disappeared but he has not lost the peculiar individuality which then seemed to be bound up with it. Mr. Denman's "In Blossom Time" is a "decorative" picture with two girls' figures and a great mass of azalea blossoms. The scale is very light but the color very charming; and had both figures been as well posed and characterized as is the one sitting on the floor, it would have been a singularly successful work in its own pleasing though not very profound way. Mr. Creifeld's picture of three sailors, called "An Idle Hour," deserves attention as do also Mr. Alexander's "Chestnuts" — the figure of an old negro, and Mr. Carlsen's large impressionistic study of pink peonies. And Mr. Dodge's "Death of Minnehaha" should be commended as an attempt at once very ambitious and very serious, and as, if nothing more, a good "academy" which is both fresh in theme and dignified in treatment and in which certain textures are extremely well expressed. If, as I am told, this artist is also very young, he may certainly be congratulated upon a promising *début.*

And finally it is a pleasure to say that among the more or less excellent pieces of sculpture in the exhibition there is one at least which it is rather an under than an overstatement to call extremely fine. It is but a little thing — a charmingly-designed miniature bronze pedestal upon which stands a bronze figure not more, I should say, than twelve inches high. It is by Mr. Donohoe, whose successful large figure of the youthful Sophocles I described when speaking of the Academy exhibition; and it, too, represents an adolescent form — the boy Hannibal taking his famous oath of hostility to Rome. The figure is very simply posed at rest, the right hand hanging by the side and holding the scarcely-extended sword. The whole right side is nude, a cloak hanging over the left shoulder and shrouding something less than half the form. No composition could be more simple, yet even in this small size it has a quite heroic force and dignity and impressiveness. And the serious, proud, beautiful little head which crowns it could not be more noble in air or more vital in expression were it increased to larger than life-size. I profess myself no judge of sculpture and am not well enough acquainted with modern products to say whether such a result as this is so phenomenal as it seems to my eyes. But I think that even an ignorant commentator may venture to say that it is the easiest thing in the world to make a big statue look petty, the hardest to make a tiny statue look large; and that even an ignorant eye may be sure it has found excellence when so tiny a statue as this seems so large, so noble, so thoroughly statuesque that no one with the least sense of fitness would like to call it "a statuette"; and of having found beauty when it sees such repose and resistance combined with so much vigor, vitality and individuality. Mr. Richardson was fond of trying to explain the difference between a "little big thing" in art and a "big little thing." This young Hannibal certainly deserves the latter phrase and its beauty seems to me on a par with its real — not its mathematical — size. Had its exhibitors done it justice they would have thought no pains too great to give it prominence and due relief. But, unfortunately, it has been placed on top of a high glass case filled with bric-à-brac where I fear many eyes will pass it by unseen. And had the prize-givers been as wise as they were doubtless conscientious I am inclined to think it would have gone to the Metropolitan Museum or the Union League Club in place of one of the paintings they preferred to it.

A collection of French pictures, imported in bond "for exhibition only" has recently been placed on view at the Academy, filling all its rooms. It is a singular collection, containing many good pictures of many dates and schools, but also many poor ones of the sort we fondly think have "gone out of fashion." And not the least singular thing about it is why it was imported — since it is difficult to credit a dealer with disinterested educational aims upon a foreign land, especially when his importation is of such a sort as to prove that if such aims exist they must be of a very vaguely Catholic sort. But, for whatever reason they may have been brought, there are some among these pictures we are very glad to see. Impressionist examples are numerous and some of them very interesting though but in rare cases as interesting as even the average at the large Impressionist exhibition of last year. The great landscapists are represented chiefly by Rousseau — in two large and very singular examples — and by Dupré, one of whose canvases is of the very best sort which even he ever produced — a moonlight sea-piece of truly marvellous charm. There are several small Henners, good but not especially good, and the large "Eglogue" with two life-size nymphs one of whom is piping to the other. Even those who like Lefebvre's kind of art will hardly be charmed with his big group called "Diana surprised" though I believe it is one of his most "famous" products. There is also a small figure by Meissonier; some excellent works by Gaillard; an interesting large picture called "The Death of a Bull" by Falguière, the sculptor; an admirable landscape with large figures of a peasant woman by Billet; a delightfully simple and fresh pastel of two children with a cat, by Bartholomé, and a long array of works good, indifferent, and bad which when they do not delight us at least serve the purpose of introducing untravelled eyes to many names that have become more or less familiar in print.

But the chief features of the exhibition, not excepting its Impressionist elements, are the two Delacroixs and the ten canvases by Puvis de Chavannes. One of the former is a very beautiful, comparatively small work with many figures, showing a mediæval interior and some sort of a judgment-scene, the meaning of which is not made particularly clear by the catalogue title, "The Honorable Amend." The other is the large "Death of Sardanapalus" which belongs, I believe, to an English collector. The huge canvas with its innumerable life-size figures — Sardanapalus on his couch and his women being murdered all about him, while a circle of fiery smoke fills the distance — does not show the great master at his best, revealing all his weakness as a draughtsman but by no means all his strength as a colorist. But it is an interesting thing to have seen and an impressive thing when we pause to think how few men there have been since Rubens who would have dared even to attempt such a task, much more who could have executed it with such force and fire and riotous audacity. To-day when it is permitted to any one who can to be audacious in any way he chooses, it is a startling and exciting thing to see; but when it was painted, in the early days of romantic protest against classic restraint and formalism, it is small wonder that its author seemed almost more than mortal to his admirers. And since that day there has certainly been no one but Regnault who could have come within measurable distance of this mighty piece of work whose mighty faults seem scarcely more than a necessary part of its exuberant audaciousness.

Those who admire Puvis de Chavannes admire no one more; but I think they do not often try the experiment of persuading into admiration those whose liking has not come of itself. An art so individual as his, and the individuality of which lies so largely in its abstractness, in its conventions (which is by no means an exchangable term with *conventionality*) alike of form and of color, cannot be explained to those who do not understand it, and cannot be praised in such a way that those who dislike it will be converted. Nor do I think that the pictures in this exhibition will produce as good an impression upon unaccustomed eyes as we who admire and love the artist would wish. Before all else his work is monumental in conception and in execution, and monumental art is never faithfully and fully translated in small replicas. Most of these pictures are such replicas — or, I should say, are the studies for works afterwards executed in large. And the very qualities which make the large results so admirable are those which it is difficult to appreciate in the small. The vast Panthèon decoration showing the life-scenes of St. Geneviève is too famous and too familiar to travelled eyes to need my praise. But seen here on a canvas but some ten or twelve feet long, it will give no adequate account of itself. The extreme abstractness of its design and simplicity and pallor of its color, which fit it so wonderfully well for its rôle as a piece of architectural decoration, become thin and tame and almost puerile here, except to well-trained eyes. I think no one would speak of affectation and stimulated *naïveté* in presence of the Panthèon picture, which makes all its neighbors seem exaggerated or out of place, so beautifully and adequately yet modestly does it play its architectural rôle; yet I find these words in certain criticizing mouths here in New York and can understand to some degree what prompts them. The only picture by the master which really does him justice in this exhibition is the famous "Poor Fisherman" — though even this, I think, is not the largest version Puvis de Chavannes has painted of the subject. Its extraordinary simplicity alike of mood and manner, the marvellous beauty drawn from the actual hideousness of the chief figure, the archaic repose and grandeur and yet tenderness of the whole composition, and the exquisite serenity of the wide monotonous stretch of land and water, work together to produce an impression such as one might think no product of our sophisticated time could give. If for the sake of this picture only we may be very glad indeed of the advent of this curious collection.

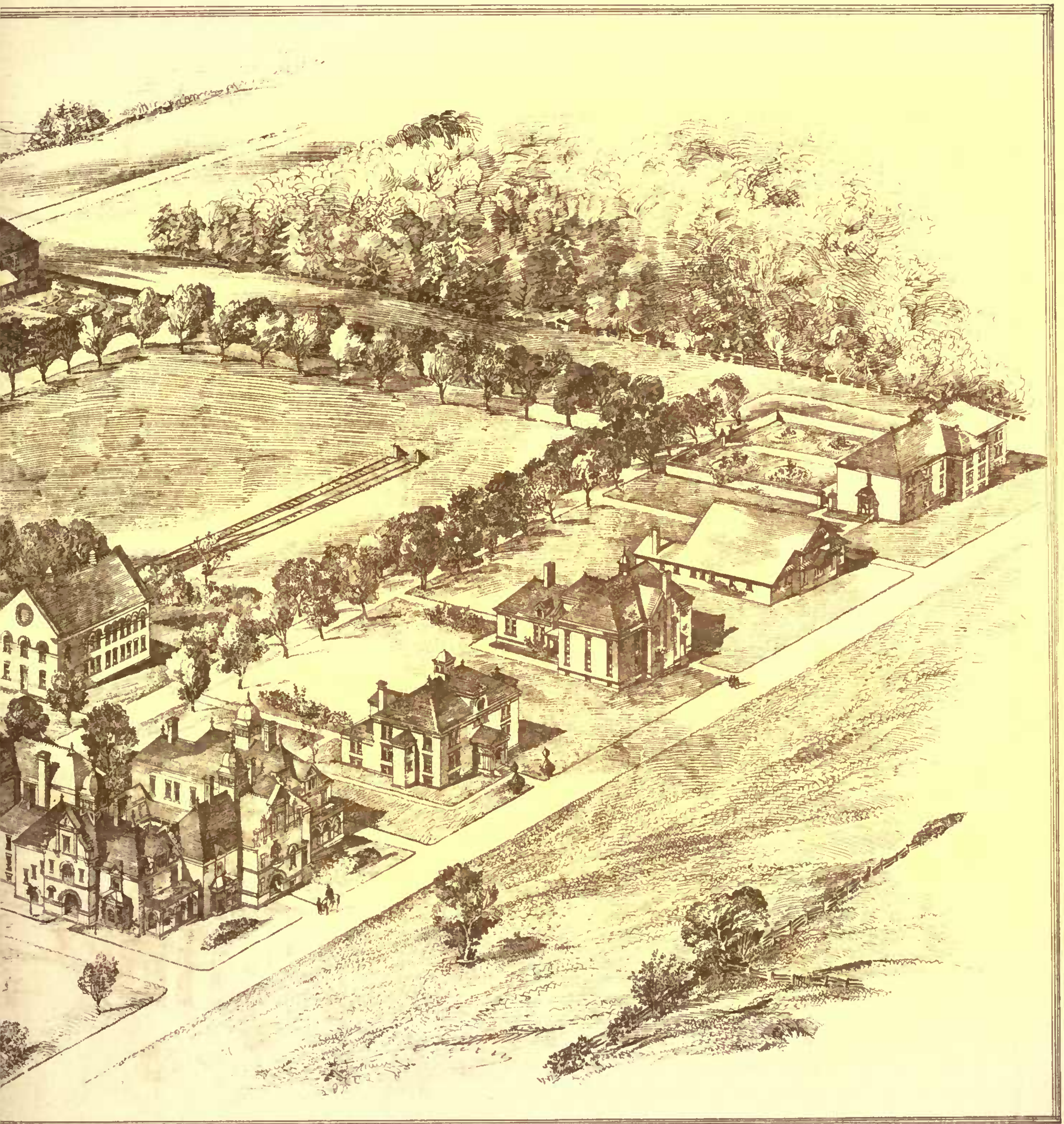
M. G. van Rensselaer.



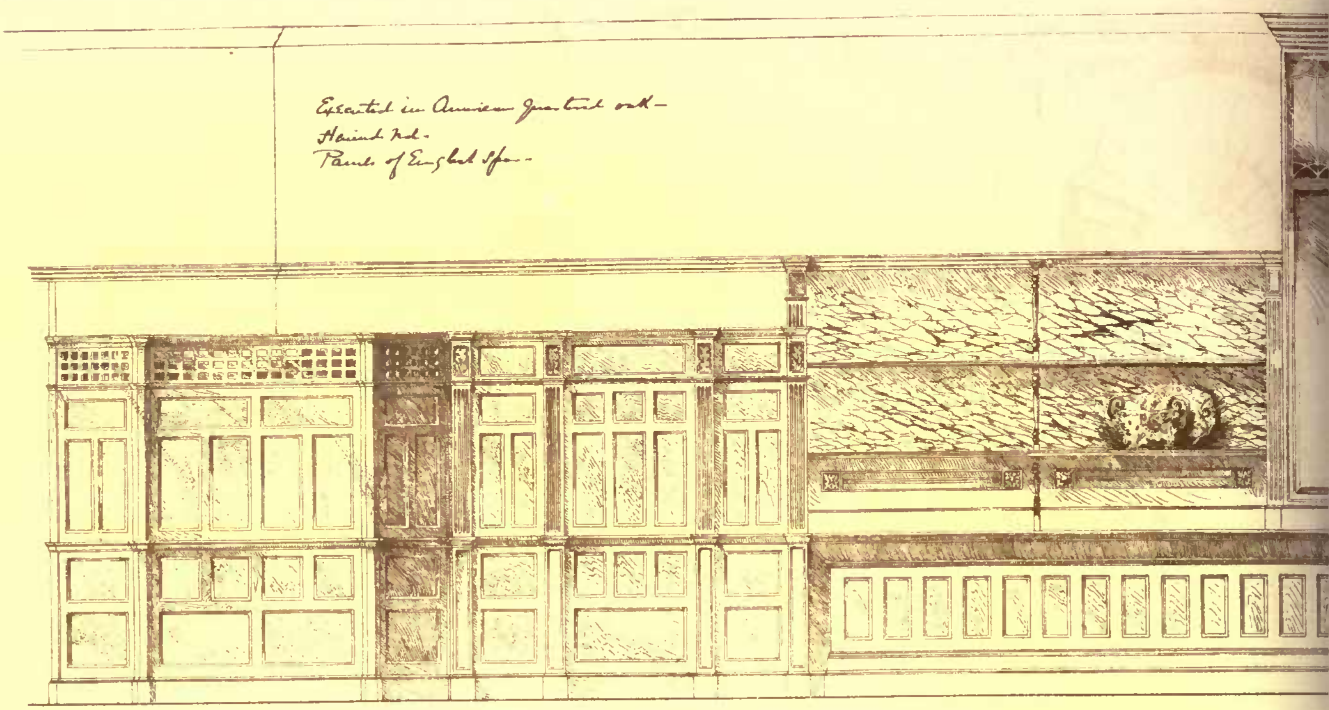
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An Apsidal Window, Aulnay. France.

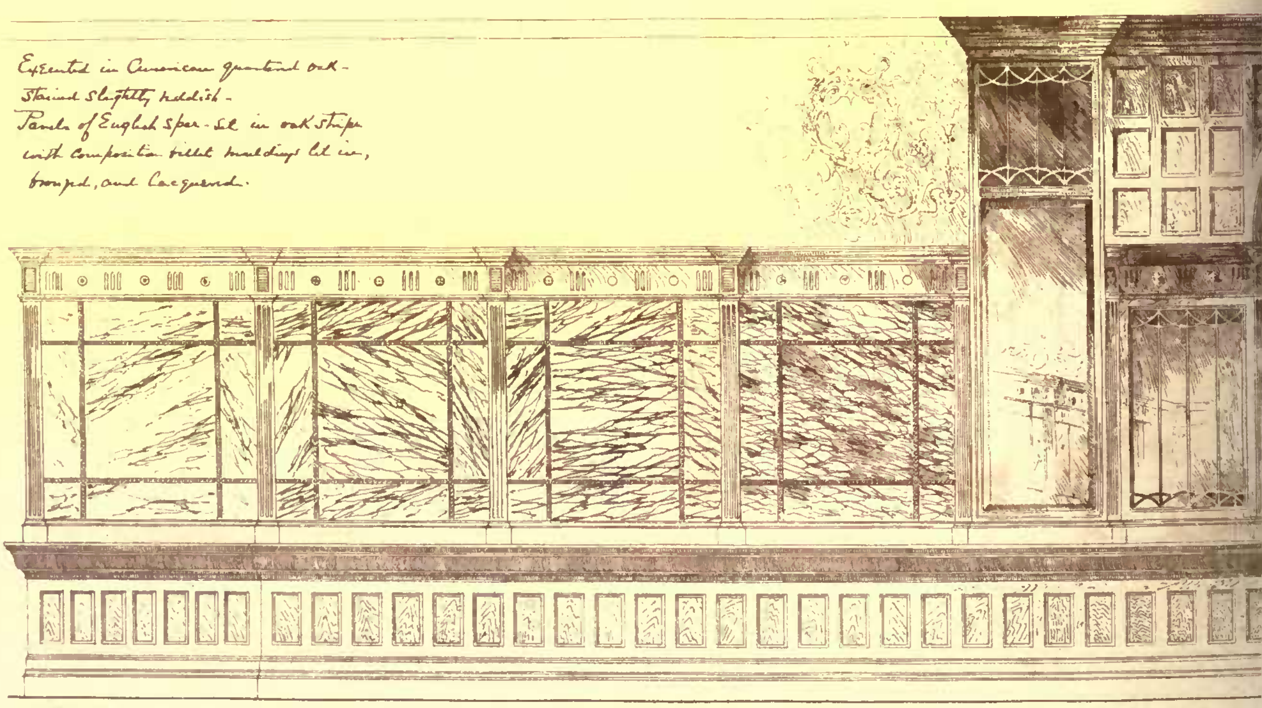

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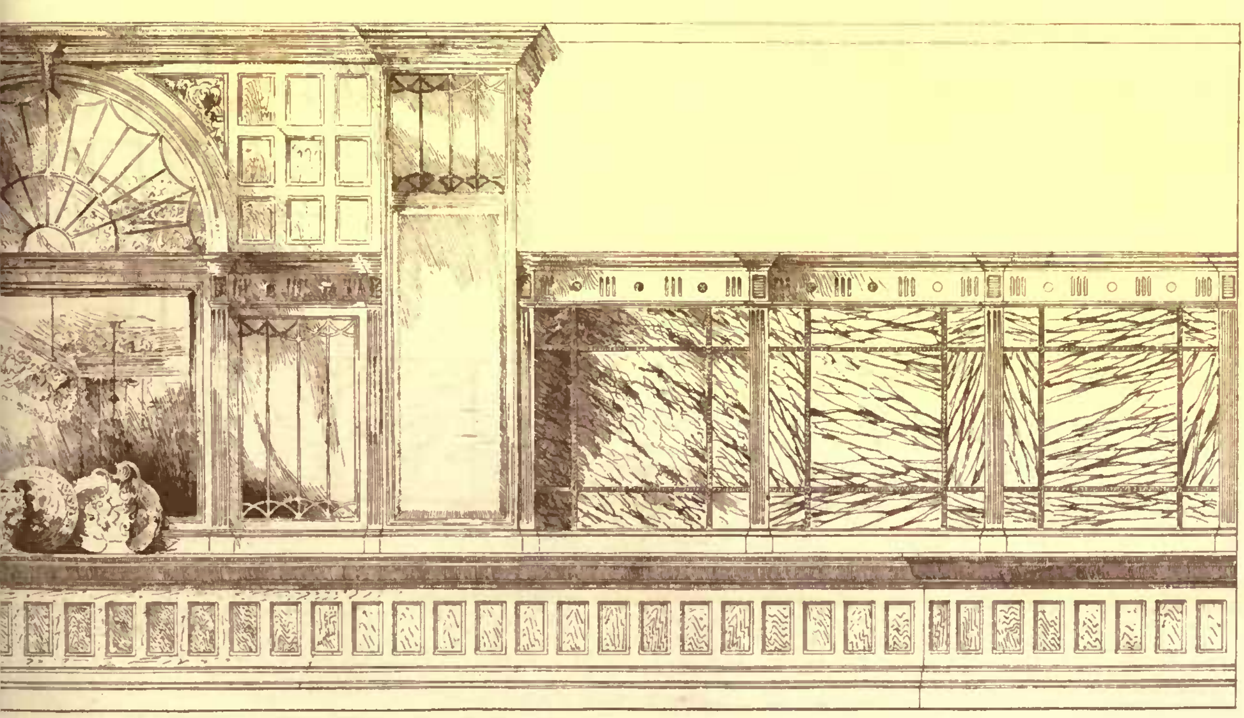
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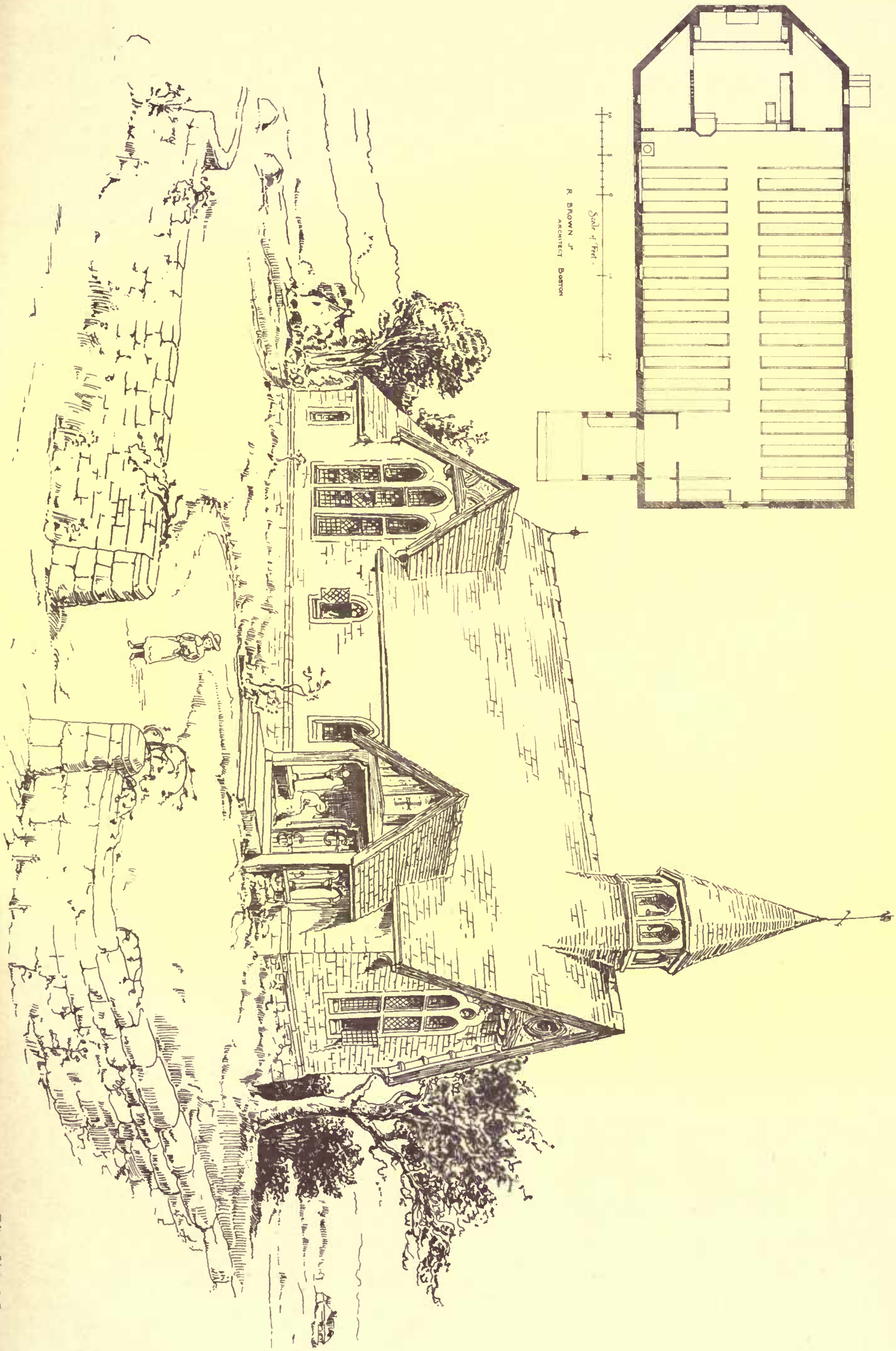


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[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE ROTCH TRAVELLING-SCHOLARSHIP DRAWINGS. — PLATES LII., LIII., LIV.

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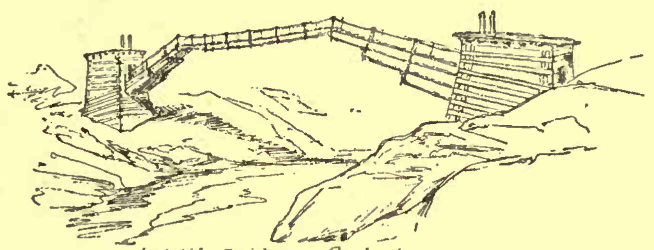
PRELIMINARY SKETCH FOR A SUBURBAN EPISCOPAL CHURCH. MR. ROBERT BROWN, JR., ARCHITECT, BOSTON, MASS.

HOSPITAL FOR THE INSANE, RICHMOND, IND. MR. E. F. KETCHAM, ARCHITECT, INDIANAPOLIS, IND.

INTERIOR FITTINGS OF DELMONICO'S RESTAURANT, NEW YORK, N. Y. MR. J. B. LORD, ARCHITECT, NEW YORK, N. Y.

A BAY OF THE APSE, AULNAY-DE-SAINTONGE, FRANCE.

A WOMAN'S ARCHÆOLOGICAL WORK IN THE NORTH-WEST.



Native Bridge in Cashmir.
after sketch by Wm. Simpson

UMATILLA, OR., May 27.

FROM the blown forelands and grave and dark seas of the Pacific and Puget Sound to this desolate sand-desert, where the Columbia and Umatilla unite their waters, what contrast could be stronger? Bruit of a remarkable collection of archæological treasures drew me hither, and I found on coming that the village, Umatilla, which has now such an antiquarian reputation, itself is a relic. Originally a site of placer mines, afterwards a mart of frontier trade, still later, the mines being exhausted and abandoned, a prominent landing-place of the Columbia-River boats in their more northern voyages, it is now little more than the point of connection of the northern and central railway systems. Apparently, the little cluster of brown buildings which forms the depot constitutes also the village. The trains pass invariably in the deepest hour of the night, so that no tourists see Umatilla, and it is known to travellers generally only by hearsay, and, in these later days, by little of that.

The sea of heaps of wind-blown sand which extends from the depot to the greater river, preventing streets and paths, and almost preventing roads, presents no lure to tourist or emigrant. But to the comer skilled in such things they at once advertise that they were built not by nature, but by man, and the dust of their architects yet speaks from them in a tongue no man can understand. These mounds, with an underground railroad of related formation extending east some three score of miles to the John Day River, where Captain Bendire has made no mean discoveries, and west to the Dalles, present indications of pronounced archæological riches. Over and above them are still scattered the arrow-points and flaky fragments of the stone implements belonging to the race which produced them. Protests are they not of the low and level land against itself, created by the same aspiration which in similar localities produced Babel and the pyramids? For the people that formed them differed certainly in æsthetic endowment and social habit, if not in physique, from any that have succeeded them.

Hither, a score of years ago, came Mr. J. H. Kunsie and his young wife, "to settle and grow up with the country." It is almost as dangerous to transplant a family as a tree, but one can imagine no surprise ruder than the transition from a home of refinement to one in such a locality as this Umatilla at that time. "There was literally nothing here when we came but sand and Indians," said Mrs. Kunsie to me. "I found I could sit and cry my eyes out longing in vain for the old home, or I could address myself to finding out what there might be of good around me."

So the young wife began to translate into action the answer of Thoreau to Lord Cholmondeley and look for her Victoria Regia on those sand-wastes. Such an effort and so prolonged is notable in the catalogue of heroisms which illustrate the earlier history of this new country. Still it is given to few to be free while one is yet young, and to be seconded and supported as Mrs. Kunsie was by her husband in her explorations. She soon discovered that the arid peninsula on which stood their home was fertile in a most extraordinary wealth of antiquities. The very sand about her doorway was printed with the traces of an extinct people, and amid the mussel-shells bleaching on the river's banks were its decorated treasures, for ages awaiting recognition. And here, mainly with her own hands, she has gathered the only representative collection the State of Oregon contains, more extensive than that of the Williamette Valley in Portland, or that of the Puget-Sound shores in Port Townsend. It is worthy of a more direct attention than has ever been accorded to it.

At a first view of the exhibit one is struck by the conventional use of natural objects: the evident materialization of myths, such as horn serpents devouring their tails, the traces of symbolic rock-picture writing, and other still more peculiar evidences of a superior and masterful race. Conspicuous among the finds are the simple implements of amusement (disk-stones and gambling-sticks exquisitely finished) and the articles of adornment, mainly beads of glass and stone. Of the latter, some are of unusual size, being two and one-fourth inches long, and weighing two ounces. Many are polychrome, resembling those discovered in the Mohawk village, Leontogen, destroyed by the French in 1666. These beads were the bequeathed wealth, the dowry of bridehood, perhaps the bravery of the daughters of the town. The ornaments of polished stone are surpassed in variety only by the Catlinite red pipestone ornaments. Weapons of the hunt and battle diversify the collection with their remarkable variety. Here are stone-swords, slate-lances, and spear-heads, and spear-points, and daggers of flint. The spear-heads are most delicately fashioned, even out of material as refractory as quartz. Here, also, are dark-green jade axe-heads highly polished, axes of granite and hornblende, and war-clubs, some exactly resembling those fashioned by the Sandwich Islanders, and others with the peculiar, chiselled, prehistoric ring found among the copper ledges of Lake Superior.

As in all other similar collections, the sacred pipe emphasizes the antiquity of the narcotic habit. The general form of the calumets is more simple (and therefore, presumably, more ancient) than those found in the lower latitudes of America. The bowls are clumsy, and one or two illuminate the collection with an unmistakable effort towards the grotesque and emblematic, for one cannot otherwise readily interpret the artificial exaggerations out of all anatomical proportion here and there attempted. The largest of these pipes is four feet long and weighs half a pound. The smallest is six inches long and weighs six ounces. Some are elaborate, and some are fac-similes of the modern cigar-holder.

But it is in images (or idols) that the ingenuity and hand-sleight of the makers of these things found fullest expression. These have been found in the greatest profusion; some with crossed hands chained, and curled-up limbs, others erect and symmetrical, still others half-human and half-animal, but all, whatever their symbolic shape, hollowed slightly on the topmost part (whether back, or tail, or head, or protuberant ribs) for incense-holding. The outlines of the human face are hardly decipherable in some. There must have been an idol manufactory near the Dalles. Many forms of rude statuary, even including that of the cross, have been found *cached* near there; faces, half-owl, half-human, armadillos, crystal eels, stone bugs, rabbits, frogs with tails, and other charms and fetiches. There are also heads of coyotes and serpents, medicine-tubes, fashioned after the sinuous bodies of the latter. I noticed especially a stone monkey or baboon in sitting posture, five-and-a-half inches high and seven in circumference, weighing seven pounds.

The instruments of surgery, which are of the simplest character, and even the weaving implements, show trace of an effort towards worship in their carving and rude adornment. These and the few cooking-utensils exhumed resemble those lately discovered in Alaska buried with the dead. Evidently they were made where stone was the only mineral material to work with. And the fact that the horn is frequently found decaying suggests great age. The presence of these is like an older legend intruding on a younger. "I found," said Mrs. Kunzie, "that we were living in a great graveyard. Yonder on 'Bead Hill' and within the limit of half-a-dozen city blocks did we gather almost everything except a few valuable relics (that smell of the beaver) from Long Island, twelve miles down the river."

But in arrow-heads the ingenuity of this people is displayed in its greatest versatility. These are of all possible materials — blue and black obsidian, flint, both plain and tinted, hornblende, chert, serpentine, chalcedony, both opaque and carnelian — and every one a shape of elegance. Mrs. Kunzie, who has given to this branch of her collection especial study, has them arranged in distinct orders according to her theory of their value and significance; for the variations are, plainly, not capricious, but proceed from some well-observed law which enforced subtle technical differences, affording a possible classification. One group is leaf-shaped, and these are mostly of the black volcanic glass. Another, of pure lozenge form, grooved and reticulated, exhibits delicate tracery. Still another betrays novel variations of its principle, which is cordate. The rudimentary forms favors the hornstone and other common material. But jasper, the volcanic obsidian, and quartzite are reserved for the more delicate and difficult work. Of none is the finish smooth and fine. The material was evidently fashioned by instruments which could chip, but neither grind nor polish. Moreover, a close inspection shows that few are perfect, the material being easily damaged.

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THE ROTCH TRAVELLING-SCHOLARSHIP DRAWINGS. — PLATES LII., LIII., LIV.

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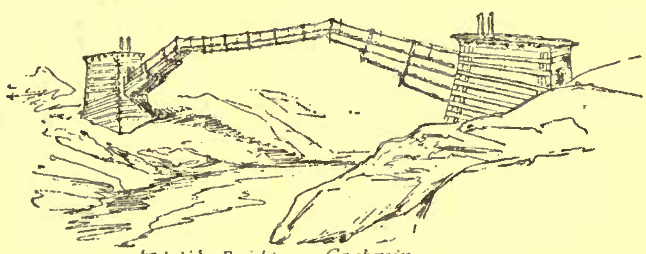
PRELIMINARY SKETCH FOR A SUBURBAN EPISCOPAL CHURCH. MR. ROBERT BROWN, JR., ARCHITECT, BOSTON, MASS.

HOSPITAL FOR THE INSANE, RICHMOND, IND. MR. E. F. KETCHAM, ARCHITECT, INDIANAPOLIS, IND.

INTERIOR FITTINGS OF DELMONICO'S RESTAURANT, NEW YORK, N. Y. MR. J. B. LORD, ARCHITECT, NEW YORK, N. Y.

A BAY OF THE APSE, AULNAY-DE-SAINTONGE, FRANCE.

A WOMAN'S ARCHÆOLOGICAL WORK IN THE NORTH-WEST.



Native Bridge in Cashmir.
after sketch by Wm Simpson

UMATILLA, OR., May 27.

FROM the blown forelands and grave and dark seas of the Pacific and Puget Sound to this desolate sand-desert, where the Columbia and Umatilla unite their waters, what contrast could be stronger? Bruit of a remarkable collection of archæological treasures drew me hither, and I found on coming that the village, Umatilla, which has now such an antiquarian reputation, itself is a relic. Originally a site of placer mines, afterwards a mart of frontier trade, still later, the mines being exhausted and abandoned, a prominent landing-place of the Columbia-River boats in their more northern voyages, it is now little more than the point of connection of the northern and central railway systems. Apparently, the little cluster of brown buildings which forms the depot constitutes also the village. The trains pass invariably in the deepest hour of the night, so that no tourists see Umatilla, and it is known to travellers generally only by hearsay, and, in these later days, by little of that.

The sea of heaps of wind-blown sand which extends from the depot to the greater river, preventing streets and paths, and almost preventing roads, presents no lure to tourist or emigrant. But to the comer skilled in such things they at once advertise that they were built not by nature, but by man, and the dust of their architects yet speaks from them in a tongue no man can understand. These mounds, with an underground railroad of related formation extending east some three score of miles to the John Day River, where Captain Bendire has made no mean discoveries, and west to the Dalles, present indications of pronounced archæological riches. Over and above them are still scattered the arrow-points and flaky fragments of the stone implements belonging to the race which produced them. Protests are they not of the low and level land against itself, created by the same aspiration which in similar localities produced Babel and the pyramids? For the people that formed them differed certainly in æsthetic endowment and social habit, if not in physique, from any that have succeeded them.

Hither, a score of years ago, came Mr. J. H. Kunsie and his young wife, "to settle and grow up with the country." It is almost as dangerous to transplant a family as a tree, but one can imagine no surprise ruder than the transition from a home of refinement to one in such a locality as this Umatilla at that time. "There was literally nothing here when we came but sand and Indians," said Mrs. Kunsie to me. "I found I could sit and cry my eyes out longing in vain for the old home, or I could address myself to finding out what there might be of good around me."

So the young wife began to translate into action the answer of Thoreau to Lord Cholmondeley and look for her Victoria Regia on those sand-wastes. Such an effort and so prolonged is notable in the catalogue of heroisms which illustrate the earlier history of this new country. Still it is given to few to be free while one is yet young, and to be seconded and supported as Mrs. Kunsie was by her husband in her explorations. She soon discovered that the arid peninsula on which stood their home was fertile in a most extraordinary wealth of antiquities. The very sand about her doorway was printed with the traces of an extinct people, and amid the mussel-shells bleaching on the river's banks were its decorated treasures, for ages awaiting recognition. And here, mainly with her own hands, she has gathered the only representative collection the State of Oregon contains, more extensive than that of the Williamette Valley in Portland, or that of the Puget-Sound shores in Port Townsend. It is worthy of a more direct attention than has ever been accorded to it.

At a first view of the exhibit one is struck by the conventional use of natural objects: the evident materialization of myths, such as horn serpents devouring their tails, the traces of symbolic rock-picture writing, and other still more peculiar evidences of a superior and masterful race. Conspicuous among the finds are the simple implements of amusement (disk-stones and gambling-sticks exquisitely finished) and the articles of adornment, mainly beads of glass and stone. Of the latter, some are of unusual size, being two and one-fourth inches long, and weighing two ounces. Many are polychrome, resembling those discovered in the Mohawk village, Leontogen, destroyed by the French in 1666. These beads were the bequeathed wealth, the dowry of bridehood, perhaps the bravery of the daughters of the town. The ornaments of polished stone are surpassed in variety only by the Catlinite red pipestone ornaments. Weapons of the hunt and battle diversify the collection with their remarkable variety. Here are stone-swords, slate-lances, and spear-heads, and spear-points, and daggers of flint. The spear-heads are most delicately fashioned, even out of material as refractory as quartz. Here, also, are dark-green jade axe-heads highly polished, axes of granite and hornblende, and war-clubs, some exactly resembling those fashioned by the Sandwich Islanders, and others with the peculiar, chiselled, prehistoric ring found among the copper ledges of Lake Superior.

As in all other similar collections, the sacred pipe emphasizes the antiquity of the narcotic habit. The general form of the calumets is more simple (and therefore, presumably, more ancient) than those found in the lower latitudes of America. The bowls are clumsy, and one or two illuminate the collection with an unmistakable effort towards the grotesque and emblematic, for one cannot otherwise readily interpret the artificial exaggerations out of all anatomical proportion here and there attempted. The largest of these pipes is four feet long and weighs half a pound. The smallest is six inches long and weighs six ounces. Some are elaborate, and some are fac-similes of the modern cigar-holder.

But it is in images (or idols) that the ingenuity and hand-sleight of the makers of these things found fullest expression. These have been found in the greatest profusion; some with crossed hands chained, and curled-up limbs, others erect and symmetrical, still others half-human and half-animal, but all, whatever their symbolic shape, hollowed slightly on the topmost part (whether back, or tail, or head, or protuberant ribs) for incense-holding. The outlines of the human face are hardly decipherable in some. There must have been an idol manufactory near the Dalles. Many forms of rude statuary, even including that of the cross, have been found *cached* near there; faces, half-owl, half-human, armadillos, crystal eels, stone bugs, rabbits, frogs with tails, and other charms and fetiches. There are also heads of coyotes and serpents, medicine-tubes, fashioned after the sinuous bodies of the latter. I noticed especially a stone monkey or baboon in sitting posture, five-and-a-half inches high and seven in circumference, weighing seven pounds.

The instruments of surgery, which are of the simplest character, and even the weaving implements, show trace of an effort towards worship in their carving and rude adornment. These and the few cooking-utensils exhumed resemble those lately discovered in Alaska buried with the dead. Evidently they were made where stone was the only mineral material to work with. And the fact that the horn is frequently found decaying suggests great age. The presence of these is like an older legend intruding on a younger. "I found," said Mrs. Kunzie, "that we were living in a great graveyard. Yonder on 'Bead Hill' and within the limit of half-a-dozen city blocks did we gather almost everything except a few valuable relics (that smell of the beaver) from Long Island, twelve miles down the river."

But in arrow-heads the ingenuity of this people is displayed in its greatest versatility. These are of all possible materials — blue and black obsidian, flint, both plain and tinted, hornblende, chert, serpentine, chalcedony, both opaque and carnelian — and every one a shape of elegance. Mrs. Kunzie, who has given to this branch of her collection especial study, has them arranged in distinct orders according to her theory of their value and significance; for the variations are, plainly, not capricious, but proceed from some well-observed law which enforced subtle technical differences, affording a possible classification. One group is leaf-shaped, and these are mostly of the black volcanic glass. Another, of pure lozenge form, grooved and reticulated, exhibits delicate tracery. Still another betrays novel variations of its principle, which is cordate. The rudimentary forms favors the hornstone and other common material. But jasper, the volcanic obsidian, and quartzite are reserved for the more delicate and difficult work. Of none is the finish smooth and fine. The material was evidently fashioned by instruments which could chip, but neither grind nor polish. Moreover, a close inspection shows that few are perfect, the material being easily damaged.

Evidently these arrow-heads and spear-points were not merely perforators. Some were set in handles and used as knives. A few of the largest arrow-points and stone-knives are of clearest obsidian and beyond comparison with any similar workmanship I know. They were fabricated here, for the chips are found mingled with the product. These are not met with in those localities of Montana where the arrow-points have been found, which are generally the "surrounds" of buffaloes, where they were stampeded for slaughter. The variety of sagittarial forms especially emphasizes the ingenuity of the people. One could hardly believe that in such obdurate material as chalcedony, flint, chert, obsidian, laminæ of mica, and jade, such delicate and translucent devices could be fabricated. The curving of the barbs particularly is incomparably exquisite and delicate. The distinction between the war and game points is everywhere clearly emphasized. The former are unmistakable, with their sharp beards and serrated harpoon edge. The latter are small, slender, and jewel-like. There is no other trace in the western part of the continent of such points, even could the same beautiful minerals be found.

The calcareous deposits in which these things are found indicate age. Some are tinted with a mineral paint. Fossil fish of a cream-colored stone are occasionally found in the deposits of red porous tufa. Similar relics have been discovered among the continuous elevated apartments of the cliff-dwellers, and scattered among the plume-sticks in the cave-shrines of the Pueblo Zuñis, and the mounds of Pemaquid, Me. The Skuzki, that early relic literature of Russia, mentions similar formations of silicious clay. But most, perhaps, they appear among the elevated graves of wreaths and hoops (so fashioned for the spirits to ascend) of the *Itumbi-bikju* (Tombigbee) of the lower Mississippi. They even appear among the sand-pillars of Central Asia.

I was especially interested in the variety of fish-hooks, bowls, and spoons of mountain-sheep horn, elaborately fashioned bone fibulæ for ornaments and lamps hollowed from the same substance. These constitute a small museum of themselves. The mortars and pestles often pique curiosity to determine their purpose, being imitations of some animal or bird of the wood, never of the sea, in which they contrast with the jasper mortars of maritime West Washington, the pestles of which are generally seal-heads with protuberant elevated eyes. No distinct pottery has been found here. Even after the tremendous wind storms have dug out the mounds, enlarging and deepening the excavations, no pottery is exhumed except from the more modern *caches*. This absence is the more noticeable because the skull-heaps of Clatsop and the country immediately south and west, the native sites of Colorado and California, even as far down as New Mexico and Yucatan, Japan, Corea, and the Aleutians, furnish them in plenty.

The Calendar and Totem posts, and Calendar-stones and grain-stones of this singular collection deserve a word of remark. The grain-stones, prepared for grinding grain, resemble the lava grain-tables of New Mexico. The Calendar-stones have their like nowhere else. The most noticeable is three feet in height, weighs thirty pounds, and has thirty-one notches along one of its lower edges for the days of the month. There is also a stone metate nineteen inches long, thirteen wide, and weighing fifty pounds, and found near it was a murderous-looking knife.

But who were they that knew this mystery? The tribes in their reserves, hereabouts, know nothing about the lost people who did this work. When shown it, they simply shake the head or mutter, "Very old, very." Sometimes, stimulated by reward, the natives spend months elaborating a lance or spear-head, but their clumsy imitation immediately advertises how completely the marvellous head and hand-craft which produced this delicate tracery has been lost. These half-civilized, half-savage camas-diggers care nothing for the mounds which hold these memorials. The cunning of the hand, apparent in the more severe and simple sacrificial and ceremonial apparatus, sewn with sinew and fashioned with seemingly no other implements than edged drills and adzes of fish-bone or knives, needles, and spoons from the antelope, has not survived. Moreover, these Indians have not their forefathers' skill with the bow and arrow and dart. Was wit lost with rancor? Did the secret of the silent death disappear with the Indians' fanfaronnading days? Did it perish when skins and wampum gave place to coin and duffel? The weapon has gone with its chase.

No less enigma is that of the origin of the material itself. For the substances of which these things are made are not found on the banks of the Columbia or Umatilla — no, not within a thousand miles' travel. They are not known to our geology west of the Rocky Mountains. The earlier Southern races produced some similar results from the woven tulares of California. But the people who originated this work were migratory, for every object in the collection, large or small, even every utensil of any bulk, has a hollow band chiselled around its entire surface for convenience in carrying. Frequently these curved fractures are more ingenious than the relic itself, and the lines are so true even in obdurate mineral, such, for instance, as the moss agate, that the conclusion is almost irresistible that the work was done with jewels, but none of these save a few opals and translucent stones have been found in the heaps.

Mr. Eels, an American antiquary, has published the only statement I have seen relating to these remnants. He compares them with those which have been found west of the Canadas. Mr. Kunzie has a theory that the race which produced them, finding, in its wandering, salmon and clams hereabout, *cached* its treasures and continued its journey south, hoping to return, but found the barriers of the Blue Mountains and the Cascades impassable.

This cabinet affords, certainly, the nucleus of a State museum and perhaps bureau of ethnology. The antiquity of some of its treasures antedates history. Whence came, for instance, the Egyptian heads and lava ornaments occasionally exhumed from these refuse heaps? Not even the tribes of the Queen Charlotte Islands, who have accomplished such rare results with slate and silver, have equalled some of this work. Only the Aztec and Toltec people have surpassed it.

Fine and melancholy race, it has long since trodden its pathway to the grave, but the genius of it has materialized in the dusk and shadow of these *tumuli*. From the débris and drift of this old mining camp, from all places where the earth has been pierced, appear these interesting memorials. — *Charles J. Woodbury, in the New York Evening Post.*

A NEW PROCESS OF CASTING METALS UPON COMBUSTIBLE MATERIALS.[1]


St. John's Gate. Clerkenwell. London. Engd. Original Gate House of the Monastery of S. John of Jerusalem

THE art of making charcoal — if, indeed, so crude a process is worthy of being dignified by the name of an art — dates back to a remote antiquity, and has been practised with but little change for hundreds of years. It is true that some improvements have been recently made, but these relate to the recovery of certain volatile by-products which were formerly lost.

Every one is familiar with the appearance and characteristics of ordinary charcoal, yet I hope to show you this evening that we still have something new to learn about its qualities and the unexpected practical uses to which it may be applied.

We commonly regard charcoal as a brittle, readily combustible substance, but we have before us specimens in which these qualities are conspicuously absent. Here is a piece of carbonized cotton sheeting, which may be rolled or folded over without breaking, and, as you see, when placed in the flame of a Bunsen burner, the fibres may be heated white-hot in the air, and when removed from the flame, the material shows no tendency to consume. Here, again, we have a piece of very fine lace, which has been similarly carbonized, and displays the same qualities of ductility and incombustibility.

These carbonized fabrics may be subjected to much more severe tests with impunity, and, when I tell you that they have been exposed to a bath of molten iron without injury, you will readily admit that they possess some qualities not ordinary associated with charcoal. When removed from the mould in which they were placed after the iron-casting had cooled, not a single fibre was consumed, but, upon the face of the casting there was found a sharp and accurate reproduction of the design, thus forming a die. This die may be used for a variety of purposes, such as embossing leather, stamping paper, sheet-metal, etc., or for producing ornamental surfaces upon such castings.

Some of the carbonized fabrics displayed upon the table are almost as delicate as cob-webs, and one would naturally suppose that when a great body of molten metal is poured into a mould in which they are placed, they would be torn to fragments and float to the surface even though they were unconsumed, yet such is not the case. I have found in practice that the most delicate fabrics may be subjected to this treatment without danger of destruction, and that no special care is needed either in preparing the mould or in pouring the metal.

By the aid of the megascope, the enlarged images of some of these castings, showing the delicate tracery of the patterns, will now be projected upon the screen, and you can all see how perfectly the design is produced.

In these experiments, the mould was made in "green sand" in the ordinary manner, and the fabric laid smoothly upon one face, being cut slightly larger than the mould, in order that it might project over the edge, so that when the moulding-flask was closed, the fabric was held in its proper position. As the molten metal flowed into the mould, it forced the fabric firmly against the sand wall, and when the casting was removed, the carbonized fabric was stripped off from its face without injury. In this way several castings have been made from one carbonized material.

These castings are as sharp as electrotypes, whether made of soft fluid iron or of hard quick-setting metal. This peculiarity is owing to the affinity between molten iron or steel and carbon, the molten metal tends to absorb the carbon as it flows over it, thus causing the

[1] Abstract of remarks, by A. E. Outerbridge, Jr., made at the Stated Meeting of the Franklin Institute, Wednesday, April 20, 1887.

fabric to hug the metal closely. It is somewhat analogous to the effect of pouring mercury over zinc. You know that when mercury is poured upon a board, it runs in a globular form, it does not "wet" the board, so to speak, but when poured upon a plate of clean zinc, it flows like water and wets every portion of the zinc; or, as we say, it amalgamates with the zinc; so when molten iron is poured into an ordinary sand mould, which has been faced with this refractorily-carbonized fabric, it wets every portion of it, tending to absorb the carbon, and doubtless would do so if it remained fluid long enough, but as the metal cools almost immediately, there is no appreciable destruction of the fibres.

The casting which I shall now exhibit represents a very interesting and novel experiment. In this case, the piece of lace, having open meshes a little larger than a pin's head, instead of being laid upon one face of the mould, was suspended in it in such a way as to divide it into two equal parts. Two gates or runners were provided, leading from the "sinking head" to the bottom of the mould, one on each side of the lace partition, the molten iron was poured into the sinking head and flowing equally through both runners, filled the mould to a common level. The lace, which was held in position by having its edges imbedded in the walls of the mould, remained intact. When the casting was cold, it was thrown upon the floor of the foundry and separated into two parts, while the lace fell out uninjured, and the pattern was found to be reproduced upon each face of the casting.

The question naturally arises, why did not the iron run through the holes and join together? The answer may be found in the fact that the thin film of oxide iron or "skin," as it is popularly called, which always forms on the surface of molten iron, was caught in these fine meshes, and thus prevented the molten metal from joining through the holes. I have repeated the experiment a number of times, and find that the meshes must be quite small (not over one-fiftieth of an inch) otherwise the metal will reunite.

I think that this observation explains the cause of many obscure flaws found in castings, sometimes causing them to break when subjected to quite moderate strains. We frequently find little "cold shot," or metallic globules, imbedded in cast-iron, or steel, impairing the strength of the metal, and it has long been asked, "What is the cause of this defect?" The pellicles have been carefully analyzed, under the supposition that they might be alloys of iron and nickel, or some other refractory metal, but the analysis has failed to substantiate this theory. Is it not probable that in the process of casting little drops of molten metal are sometimes splashed out of the stream, which immediately solidify and become coated with a skin of oxide, then falling back into the stream of rapidly cooling metal, they do not remelt, neither do they weld or amalgamate with the mass owing to this protective coating, thus forming dangerous flaws in the casting?

The process of carbonizing the delicate fabrics, leaves, grasses, etc., is as follows: The objects are placed in a cast-iron box, the bottom of which is covered with a layer of powdered charcoal or other form of carbon, then another layer of carbon dust is sprinkled over them, and the box is covered with a close-fitting lid. The box is next heated gradually in an oven, to drive off moisture, and the temperature slowly raised until the escape of blue smoke from under the lid ceases, the heat is then increased until the box becomes white hot, it is kept in this glowing condition for at least two hours; it is then removed from the fire, allowed to cool, and the contents are tested in a gas flame. If they have been thoroughly carbonized, they will not glow when removed from the flame, and the fibres may even be heated white hot before consuming.

Of course, the method employed to carbonize the materials is susceptible of variation, but the scientific principles involved are unchangeable, viz.:

(1) Partial exclusion of air and substitution therefor of a carbon atmosphere.

(2) Slow heating to drive off moisture and volatile elements.

(3) Intense and prolonged heating of the partly charred objects to eliminate remaining foreign elements, and to change the carbon from the combustible form of ordinary charcoal to a highly refractory condition.

BOOKS PAPERS

UPON the base or plinth of the famous statue of Zeus at Olympia, Phidias[1] inscribed his name, and the place of his birth. According to the account by Pausanias, the words ran thus: "Phidias, the son of Charmides, an Athenian, made me." We know nothing of Charmides beyond this brief statement; but as it was usual amongst the Greek sculptors to sign themselves "son of ——," as we moderns call ourselves "pupil of ——," it is probable that he, too, was a sculptor. At the same time M. Longpérier has discovered the name upon some vases of the best Greek period; and ventures upon the conjecture that the son may have furnished designs for the father, who was a potter. However this may be, we know that Phidias had a brother named Panainos who was a painter, and whose name figures by the side of those of Micon, and of Dionysios of Colophon, artists, who under Polygnotus did so much towards the develo ment of art in Attica. Phidias himself seems to have made his *début* as a painter, and it may be to his love of color that the antique world owed his chryselephantine statues.

When Phidias commenced his artistic career in 475 B. C., Greek art had already made its exit from the Archaic period. From 500–480 B. C. three schools were flourishing side by side: those of Sicyone, of Ægina, and of Athens. Ancient writers mention the works of Canachos and Aristocles at Sicyone, and of Onatas at Ægina, as of great merit; and we know by the sculptures of the pediment of the Temple of Athene (now in the Glyptoteck at Munich) which, if not by Onatas, were certainly executed during his life, that a high position in art was taken by the artists of Ægina. We see at once that the conventional treatment of the figure by the early sculptors was set aside, and free study from the life adopted. The hair was no longer arranged in the stiff Archaic fashion, which so resembles Assyrian sculpture; and the draperies show the form of the human body beneath them. Routine and convention were abolished, and gave place to Nature. Still, the first of Phidias's masters, was but the last of a long line of Archaic artists — the Athenian Hegias or Hegesias, and a contemporary of Critios and of Nesiotes. Quintillian speaks of his style as hard and resembling Etruscan art. At the same time there must have been some merit in it, as one of his groups, a Castor and Pollux, found its way to Rome. Phidias next studied under Ageladas at Argos, and was fellow-student with Myron and Polycletus. This master's reputation was great beyond his native country, and extended to Magna-Græcia; and it was probably to the school of Argos that Phidias owed his knowledge of working in metal, for at Athens, marble was the material mostly employed by the sculptors.

The first work of Phidias, or rather the first mentioned by ancient writers, was a statue of Athene in ivory and gold made for the town of Pellene; and we are told that underneath the plinth, there was an arrangement for emitting a damp vapor, in order to prevent the ivory from cracking.

About the year 459 B. C. may be placed the bronze *ex-voto* statue of Athene, which commemorated the battle of Marathon; and the Athene Areia for a temple at Platea, which was made of gilded wood with marble head, hands and feet.

It was during the last years of the government of Cimon that Phidias became famous by his colossal statue in bronze, called by Demosthenes Athene Promachos; and which, placed on the Acropolis behind the Propylæa, seemed to be guarding the sacred hill. According to Pausanias, the statue was so large that she was seen miles away at sea, and formed a sort of land-mark. On an Athenian coin, the goddess is one-third higher than the Parthenon; but Michaelis gives the height as only nine metres. Still it is quite possible, that being only of those dimensions, the statue may have struck terror into the souls of Alaric's Gothic followers. In the plates given by M. Collignon from Athenian coins, one sees no beauty, and no majesty — simply rude designs such as a child would draw; indeed, one of them is rather suggestive of the Royal Academy works as illustrated by Mr. Punch. The Parthenon is at the top of the rock against which is placed a primitive kind of ladder; and standing in a dramatically aggressive attitude is the statue of Athene, head and shoulders higher than the temple.

The career of Phidias proves two facts which were as patent in ancient Greece as in the modern world, viz.: that artists require encouragement from those in authority; and that a statesman shows his wisdom by surrounding himself with men of talent. Phidias was as necessary to the glory of Pericles, as Pericles was to the fame of Phidias; and thus we find the two working together to embellish their native city. Not that Athens alone gained by the artistic energy of Pericles; for although she was "gilt and decked out like a coquettish woman covered with precious stones," other cities of Greece shared in the rebuilding which was the result of the revival of artistic activity in Attica.

It is probable that, being the "friend of Pericles," Phidias was an artist of culture; and it was natural that when the Acropolis was to be beautified he should be the sculptor chosen to decorate the Parthenon. The architects were Ictinus, Callicrates, and Mnesicles, and besides these collaborators, Phidias was assisted by his pupils Alcamenes, Agoracritos, and Colotes. Of course added to these, was a whole army of masons, of workers in metal and in ivory, and of wood-carvers. Plutarch speaks of carpenters, modellers, blacksmiths, masons, painters, marquetry artists, chasers of gold, and workers in ivory. So rapidly were the works carried on, that the temple became the astonishment of Greece. But evil tongues began to wag, and the enemies of the statesman did not spare his friend the artist. The comic poets composed epigrams, the aristocrats cried out against the enormous expense, and scandal made the most of the visits of the elegant feminine world to the rising building; but all the time the sculptor was at work at his grand colossal statue of the divine Athene. In the year 438 B. C., the solemn consecration took place, and the noble protectress of the city became one of the wonders of the ancient world.

The statue was a mass of gold laid on in plates in such a manner that they could be removed, if necessary; indeed, the idea of Pericles seems to have been to make it a sort of State reserve fund. Lucian gives an account of the manner of building up these huge statues: the interior was a mass of iron bars and woodwork, and the ivory

[1] "*Les Artistes Célèbres: Phidias*," par Maxime Collignon. J. Rouam, Paris.

and gold plates were hammered and screwed on much in the manner of the metal statues of mediæval times. This mode of sculpture accounts for the numerous thefts to which the statue was subjected, and perhaps was the cause of its final destruction. When this occurred is not known, but numerous authors speak of it as in existence in the year 375 of our era. A tradition records its having been taken to Constantinople, but it is far more probable that it became the spoil of some ruthless army, and like many later works of art, was melted up to pay for war materials. When one reads of the requisitions made by François I on the treasury of Laon Cathedral (amongst others) for statues in silver, chalices in gold and silver gilt, and reliquaries embellished with precious stones, to be converted into moneys to carry on his miserable campaigns, one is not surprised at the same being done by semi-barbarians.

A number of statues have been found that give some idea of the Parthenon Athene; indeed, they are probably (judging from the descriptions by Pausanias and Pliny) early copies, but none of them can be called beautiful in our acceptation of the word. There is a certain nobility about the pose of the one found near the Varvakeion at Athens, and the helmet is of a grand form, but the face, like that of the Aspasios intaglio at Vienna, is severe rather than beautiful. But the general effect of the statue must have been magnificent: the flesh executed in ivory, the eyes of precious stones, the drapery of gold, the shield of ivory upon a gold ground, the helmet and the serpent of gilt bronze, the base decorated with rich encrustations—all this must have formed a dazzling *ensemble*.

The Parthenon remained almost intact until the year 1687, when a shell fired from the invading Venetian army, exploded in the magazine in its centre, and all but destroyed it. In the fifth century it had been converted into a Byzantine church, dedicated first to the Haghia Sophia and then to Theotokos, the Mother of God; and in 1460 it was transformed into a mosque by the Turks. M. Collignon speaks of Lord Elgin's part in the destruction of the temple as "*devastation*," but when he took possession of the marbles now in the British Museum, the natives were using them up for building purposes! Had not Lord Elgin or some one else picked up the fragments, in all probability all the sculptures which were on the ground would have perished; at the same time every one must lament the taking down of what had not already fallen. Still this can scarcely be spoken of as a "*dépouillement méthodique*," for already in 1674, when Jacques Carrey made drawings of the temple during his voyage with Louis XIV's ambassador, the Marquis de Nointel, the eastern pediment was sadly mutilated.

That the Parthenon statues are the most perfect specimens of the sculptor's art there can be no doubt. Whether we study the draperies of the "Fates," of Demeter, Kora and Iris, or the nude figure of Heracles, the modelling in each case is perfect. Why can no modern artists produce such works? A few Frenchmen are fine sculptors, but what can be said of those of other nations? If the statues of London were served as the French Revolutionists served the fine bronze tombs at St. Denis and other churches, *i. e.*, melted them up into cannon, it would be putting them to a better use than as so-called ornaments to the city.

Like most Greek sculptures, those of Phidias were colored and decorated with gold or bronze accessories. The metopes are unequal in execution, which seems to prove that the great artist did not himself execute all the work—indeed, it would have been impossible for him to do so.

The subject of the frieze which still remains on part of the inner colonnade, is the annual procession of the Panathenea, when the statue was presented with a new *peplos* richly embroidered in yellow and violet. Mr. Collignon's book contains some beautiful photogravures of portions of the sculptures of the pediment, of the frieze and of the metopes.

The varying accounts of the charges against Phidias are well-weighed in this book, and the author justly concludes that, as the gold of the statue of Athene was removable, and therefore capable of being weighed, the charge of embezzlement must, most likely, have referred to the moneys which the sculptor had confided to him for the payment of his assistants. The accusation that the artist profaned his work by placing his own and Pericles's portraits upon the goddess's shield, was one which might be brought against most of the painters of the fifteenth and sixteenth centuries. But whatever the charges, it was probably jealousy and malice which promoted them, and it was equally probable that they were false, otherwise, would the inhabitants of Elis have commissioned him to make their Olympian Zeus of the same costly materials?

This statue must have been of even more splendid effect than the Athene, for not only was it of ivory and gold, but the throne consisted of bas-reliefs and statues in the round, and ornamentation in marble and metals and precious stones. M. Collignon refutes the notion that Phidias's Zeus was modelled upon the Homeric God; as he justly remarks, if this were so, how could Dion Chrysostom speak of the expression being "peaceful and benevolent," and as that of him "who gives life and all other blessings, the father, the saviour and the protector of all mortality." As in later times, and in the presence of a totally-different kind of art, the most miserable of men forget their woes at the sight of this statue "so full of light and of grace." This could not have been said of a work which was moulded upon the Homeric idea of Zeus, the god who made all "Olympia tremble at but the shaking of his locks." Upon a coin in the French National Collection, and upon another in the Blacas collection of the British Museum, this pacific expression is portrayed. The story of the god signifying his approval of the statue by the discharge of a thunderbolt, recalls the mediæval legends of artists being rewarded by the bending of the crucified Saviour's head, or the raising of His sacred hand in benediction of the work. Upon the merits of the work of Phidias the whole world was unanimous. Dion Chrysostom calls it "perfectly beautiful," and Epictetus says, "Go to Olympia and see the work of Phidias, and consider it a misfortune if any of you die in ignorance of this marvellous statue." Quintillian considered it added something to the feeling and culture of religion, so divine was it.

All these witnesses agree in assigning to the work of the old sculptor the first rank; and whether it was suggested by Homer or not, it was the work of a matured mind and hand. But alas! like the Athene, it perished, how or when no one knows. Some authors say Caligula wished to transport it to Rome, but that the god objecting, caused the ship which was destined to take it to founder in a thunder-storm.

Others maintain that it was removed to Byzantium, where it was destroyed in the burning of the palace of Lausos in 475; but is it not more probable that it was destroyed in the burning of the temple which Theodosius II ordered in 408? Phidias was the author of many other statues; the Aphrodite Urania, and another chryselephantine Aphrodite which was placed in an Elian temple; Apollo Parnopios and a Hermes, amongst others. The colossal statues bearing the names of Phidias and Praxiteles on Monte-Cavallo at Rome are of doubtful origin, and as the inscriptions are of the fourth century, it is probable that they were placed on the statues as a testimony of their value in the eyes of the Romans of that period. A curious legend is attached to this fact. In the *Mirabilia Urbis Romæ*, translated in the time of Charles VIII of France, we read of these statues: "*Les chevaulx et hommes nuz dénontent que, au temps de l'empereur Tyberii, furent duex jeunes philosophes, c'est assavoir Praxiteles et Phitias. . . . Et qu 'ils sont nuz auprès des chevaulx dénote que les bras haulx et estendus et les doys reployez racontoient les chases advenir, et ainsi, comme ils sont nuz, ainsi la science de ce monde, en leurs entendements estoit nue et ouverte.*"

Phidias, a philosopher! such his reputation in the Rome of the Middle Ages!

Authorities differ as to the time and place of the great sculptor's death, and we leave our readers to follow M. Collignon's text in the matter, preferring to close our review of the book with some of the author's careful and well-reasoned summing up. M. Collignon points out that before the time of Phidias Greek sculpture presented two features, imitation of Nature, and the sentiment of the Ideal. By a conscientious study of the nude the predecessors of Phidias had acquired a thorough knowledge of form and movement, but they were unable to associate this with the ideal without falling into conventionality. To Phidias it was ordained to unite the two, to create a type of perfect beauty, and add to it the most thorough realism. "Phidias est en effet le maître idéaliste par excellence; c'est l'idée qu'exprime Platon lorsqu'il l'appelle un créateur. . . . Mais est-il besoin d'adjouter que cet idéal est toujours celui d'un Grec, d'une race passionnèment éprise de la beauté, et que la réalité ne cesse pas d'en fournir les éléments." "Le style de Phidias," dit M. Ronchaud, "est à la fois idéal est réel. . . . Il est réel par le naturel admirable des poses et des gestes, par la vérité caractéristique des mouvements; il est idéal par le sentiment profond de la dignité et de la beauté de la forme humaine qui respire dans les figures." And comparing Phidias with his contemporaries M. Collignon adds, "En comparant l'art de Phidias à celui de ses contemporaires les plus illustres, Myron et Polyclète, on y découvre à coup sûr des qualités qui sont communes; la perfection du style, le gout de la symétrie. . . . Mais les differences éclatent, si l'on considère quel idéal à poursuivi chacun de ces trois grand maîtres. Myron excelle à rendre l'intensité de la vie; mais il la cherche surtout dans la vérité des attitudes, et cette vie est purement corporelle. . . . Il reste le représentant le plus brillante d'école réaliste. Polyclète est le maître de cette école qui cherche la perfection dans l'harmonie et la justesse des proportions. . . . Il place son idéal dans une sorte de conception géométrique de la forme et dans le fini de l'exécution. . . . Il lui manque toutefois ce que les anciens appelaient le *pondus*, c'est-à-dire la largeur de conception et de style, et l'ampleur magistrale qu'ils reconnaissaient à Phidias. Le grand sculpteur d'Athènes n'est en effet ni un réaliste comme Myron, ni un théoricien comme Polyclète; son caractère original, c'est de faire concourir le mouvement et la forme à l'expression de la pensée. Le Zeus d'Olympie dont la vue provoquait une émotion si forte, est l'œuvre d'un génie méditatif et réfléchi, nourri de la plus haute philosophie qu'ait connue son temps et pour qui l'art n'a son prix que s'il traduit les sentiments les plus intimes et les plus religieux de l'âme. Nul artiste, dans l'antiquité, n'a pénétré aussi avant dans les profondeurs du monde moral; nul autre n'a eu au même degré cette vision de l'au-delà qui se reflète dans son œuvre. C'est la gloire de Phidias de compter parmi les rares esprits qui, dans le domaine de l'art, ont entrevu le divin, et l'ont réalisé dans la mesure des forces humaines." And speaking of the slowness with which, according to Themistius, the great artist worked, our author makes some remarks that a certain school at the present time would do well to lay to heart. "On imagine volontiers ce génie si fécond et si riche répudiant tout ce qui sentirait l'improvisation, se réglant lui-même par un besoin impérieux de perfection, n'ayant rien de cet outrance et de cette fougue qui ne vont jamais sans défaillance.

Aussi Phidias n'a-t-il pas eu de déclin. Sa dernière statue est, de l'aveu de tous, la plus parfaite, et nulle part son génie n'a plus d'ampleur et de sérénité que dans l'œuvre de sa vieillesse."

M. Collignon cites numerous authorities, but we miss the name of W. Watkiss Lloyd in the list. Like the others of the series, the book is well printed, illustrated and attractive. S. BEALE.

SOCIETIES

LOUISIANA STATE ASSOCIATION OF ARCHITECTS.

THE efforts of Mr. Thomas Sully, as a member of the Committee of the Western Association of Architects, charged with organizing State Associations, have resulted in complete success in New Orleans, a Louisiana State Association of Architects having been recently formed, of which Messrs. Thomas Sully, president, William Fitzner, vice-president, W. C. Williams, secretary and treasurer, S. M. Patton, A. Toledano, B. M. Harrod, J. A. Braun and C. A. Leffingwell are the charter members.

The particulars of this organization will be found fully given in the Constitution and By-laws, which are as follows:

CONSTITUTION.

SECTION I. — *Name.* The name of this organization shall be the Louisiana State Association of Architects.

SEC. II. — *Objects.* The objects of the Association are: To unite in fellowship the architects of Louisiana; to combine their efforts so as to promote the artistic, scientific and practical efficiency of the profession, and to cultivate and encourage the study of kindred arts.

SEC. III. — *Membership.* This Association shall consist of Fellows and Honorary Members.

SEC. IV. — *Qualifications.* "Any architect practising his profession in the State may become a Fellow of this Association. Honorary Members of this Association may be elected upon the recommendation of the Board of Directors, but all Fellows of the Association shall become Honorary Members when, after three years honorable standing as Fellows, they resign the practice of architecture. Honorary Members shall not be entitled to vote, nor be eligible to office, nor shall they be assessed for dues or initiation."

SEC. V. — *Officers.* The officers of this Association shall be a President, Vice-President, Secretary and Treasurer.

SEC. VI. — *President.* The duty of the President shall be to preside at all meetings of the Association, and in his absence the Vice-President shall preside; and, in absence of both, a fellow shall be elected to the chair.

SEC. VII. — *Secretary.* It shall be the duty of the Secretary to take the minutes of the meetings, and conduct the correspondence of the Association, subject to the Board of Directors.

SEC. VIII. — *Treasurer.* It shall be the duty of the Treasurer to collect all funds, and disburse the same on the order of the Secretary, when countersigned by the President.

SEC. IX. — *Amendments.* This Constitution may be amended by a two-thirds vote of the Fellows present at any regular meeting.

SEC. X. — *Status of Architect.* The status of an architect is hereby defined as follows, to wit: An architect is a professional person, whose sole, ostensible occupation consists in supplying data preliminary to the material construction and completion of buildings; in exercising administrative control over the operations of contractors supplying material and labor incident to the construction and completion of buildings, and in officiating as custodian and arbitrator of contracts, stipulating terms of obligations and fulfilment between proprietor and contractor.

SEC. XI. — *Failure to pay Dues.* Should any member fail for one year to pay his dues, the Board of Directors may, at its discretion, drop his name from the roll. Should charges of misconduct be preferred against any member, it must be done in writing and be signed by the person making such charge, whereupon the Board of Directors at its next meeting must take the matter up, and the said Board may, at its discretion, drop the name from the roll, and the decision of the Board shall be final and absolute. The member against whom the charges are made shall, however, have the right to be heard in his own defense.

Thomas Sully, president; William Fitzner, vice-president; W. C. Williams, secretary and treasurer.

Fellows — S. M. Patton, A. Toledano, B. M. Harrod, J. A. Braun, C. A. Leffingwell.

BY-LAWS.

ARTICLE I. — The meeting of this Association shall be held upon the first Wednesday in May, August, November and February, and at such place as shall be designated by a majority vote of members present at the previous meeting.

ART. II. — The meetings of this Association shall be conducted in accordance with "*Roberts's Rules of Order.*"

ART. III. — The Board of Directors shall consist of five Fellows, including the President, Vice-President and Treasurer, who shall have the care of the property and the management of the welfare of this Association, and shall report at each regular meeting.

ART. IV. — All officers, including Directors, shall be elected annually by a majority ballot-vote at the February meeting of this Association.

ART. V. — All papers, books and other records shall at all times be open to the inspection of the Fellows of this Association.

ART. VI. — Candidates for membership as Fellows of this Association shall pay an initiation fee of $5.

ART. VII. — All Fellows of this Association shall pay an annual due of $5.

ART. VIII. — All applicants for membership as Fellows of this Association shall be referred to the Board of Directors, who shall investigate their standing, and if found worthy, recommend them for election at the next meeting.

ART. IX. — All applicants for membership recommended by the Board of Directors, are to be voted upon by ballot, and three ballots cast against any such applicant will be sufficient for his rejection.

ART. X. — A majority of Fellows shall constitute a quorum for the transaction of business.

ART. XI. — The By-laws of this Association can be amended at any meeting by a vote of two-thirds of the Fellows present.

SCHEDULE OF CHARGES AND PROFESSIONAL PRACTICE OF ARCHITECTS, AS USUAL AND PROPER, AND INDORSED BY THE AMERICAN INSTITUTE OF ARCHITECTS AND WESTERN ASSOCIATION OF ARCHITECTS.

For full professional services (including supervision), *five per cent* upon the cost of the work.

The charge for partial service is as follows: Preliminary studies, one per cent; preliminary studies, general drawings, specifications and details, two and one-half per cent; preliminary studies, general drawings, specifications and details, three and one-half per cent.

For work that cost less than $10,000, or for monumental and decorative work, and designs for furniture, a special rate in excess of the above.

For alterations and additions, an additional charge to be made for surveys and measurements.

An additional charge to be made for alterations and additions in contracts and plans, which will be valued in proportion to the additional time and services employed.

Necessary travelling expenses to be paid by the client.

Time spent by the architect in visiting for professional consultation, and in the accompanying travel, whether by day or night, will be charged for, whether or not any commission, either for office-work or supervising work is given.

The architect's payments are successively due as his work is completed, in the order of the above classifications.

Until an actual estimate is received, the charges are based on the proposed cost of the works, and the payments are received as installments of the entire fee, which is based upon the actual cost.

The architect bases his professional charge upon the entire cost, to the owner, of the building when completed, including all the fixtures necessary to render it fit for occupation, and is entitled to extra compensation for furniture or other articles designed or purchased by the architect.

If any material or work used in the construction of the building be already upon the ground, or come into the possession of the owner without expense to him, the value of said material or work is to be added to the sum actually expended upon the building before the architect's commission is computed.

SUPERVISION OF WORKS.

The supervision or superintendence of an architect (as distinguished from the continuous personal superintendence which may be secured by the employment of a clerk-of-the-works, means such inspection by the architect, or his deputy, of a building or other work in process of erection, completion or alteration, as he finds necessary to ascertain whether it is being executed in conformity with his designs and specifications or directions, and to enable him to decide when the successive instalments or payments provided for in the contract or agreement are due or payable. He is to determine in constructive emergencies, to order necessary changes, and to define the true intent and meaning of the drawings and specifications, and he has authority to stop the progress of the work and order its removal when not in accordance with them.

CLERK-OF-THE-WORKS.

On buildings where it is deemed necessary to employ a clerk-of-the-works the remuneration of said clerk is to be paid by the owners, in addition to any commission or fees due the architect. The selection or dismissal of the clerk-of-the-works is to be subject to the approval of the architect.

EXTRA SERVICES.

Consultation fees for professional advice are to be paid in proportion to the importance of the questions involved, at the discretion of the architect.

None of the charges above enumerated cover professional or legal services connected with negotiations for site, disputed party-walls, right of light, measurement of work or services incidental to arrangements consequent upon the failure of contractors during the performance of the work. When such services become necessary, they shall be charged for according to the time and trouble involved.

DRAWINGS AND SPECIFICATIONS.

Drawings and specifications, as instruments of service, are the property of the architect.

CINCINNATI CHAPTER A. I. A.

WHEREAS, The Board of Armory Trustees, of Hamilton County, Ohio, have advertised for architects to submit plans, drawings and specifications for an Armory in the city of Cincinnati, and as the said Armory Trustees have offered no compensation for such services rendered, nor any premium for meritorious designs, nor appointed an expert jury to pass upon the merits of the same, and have, moreover, limited the time for the preparation of such drawings to the short period of twenty-eight days, and whereas the Cincinnati Chapter of Architects has adopted a code governing competition:

Resolved, That a committee of five be appointed to present said code for the consideration of the Board of Armory Trustees, and to request them to modify their conditions, in conformity with the said code, and to give a reasonable amount of time for the preparation of such designs.

And be it further resolved, That a copy of these resolutions be forwarded to the press for publication.

On motion, the following Committee was appointed to present the above resolutions to the above Board of Armory Trustees: Messrs. James W. McLaughlin, Charles Crapsey, H. E. Siter, Gustave Drach, Lucian F. Plympton.

COMMUNICATIONS

A CORRECTION.

ST. PAUL, MINN., June 7, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — We are this day in receipt of the *Architect* containing the photo-caustic reproduction of a perspective sketch prepared by us

for the proposed new New York Life Insurance Company's building here. In your description of the sketch you apparently labor under the impression that we are the architects of the building. That is erroneous, as the sketch is one that was prepared at the request of Mr. Wm. T. Booth, of the Company, but is not the one that was adopted. We understand that the Company has adopted the design of Messrs. Babb, Cook & Willard, of New York. We do not recall the exact wording of our letter to you, but regret that it should be such as to lead you to suppose that the sketch was adopted.

Very respectfully yours, Hodgson & Stem.

NOTES AND CLIPPINGS.

Secondary Cause of Death at Theatre-Fires. — Dr. Brouardel testified at the Opéra Comique inquest that he found that the deaths of the victims resulted from three causes, namely: fear stopping the heart's action, asphyxia from carbonic acid, and asphyxia from fumes of oxide of carbon arising from the burning paint on the scenery.

The Discoverer of Natural Gas. — There is one man who is deserving of a place in the history of the discovery of natural gas. Dr. Oesterleni of Findlay knew of the presence of natural gas there fifty years ago. He was passing a stone quarry and detected its presence. He made a little cone of mud over a fissure, and put a bucket over the orifice. In a few minutes he struck a match under the bucket. When the Doctor picked himself up in the adjoining corn-field the bucket was still in the air, sailing north in the direction of Toledo. It was through Dr. Oesterleni's energy, fifty years later, that the first natural-gas company in the town was organized. He had been laughed at and derided for half a century, and even after the flow had been struck in 1884, they say a good many of the people thought Old Nick had a hand in the thing somewhere.— *Pittsburgh Despatch.*

The Keely Motor. —

Oh, the funny man may giggle, but it's coming by and by —
The derided Keely motor I am building on the sly;
Hitch a belt to this invention and a power will then go forth
That will whirl the equinoxes and the axis of the earth;
It will wrench the solar system, twist the orbit of the sun —
Please invest a little money, for it is n't hardly done.
It needs another piston-rod, perhaps another screw —
But the motor will be ready in about a week or two.
It will wield a mighty power which I cannot here rehearse —
But when it gets in action it will shake the universe.
A deep, mysterious power that will reach forth wide and far,
And rattle through the galaxy and shake the polar star.
The distant Pleiades shall feel this motor of renown,
And the northern "Handle Dipper" shall turn over upside down!
But I need a little money, a few thousand — just a few —
And the motor will be ready in about a week or two.

— *New York World.*

A Curiosity of the Spheroidal State of Water. — The spheroidal state of water has long formed a favorite object for experimentation by lecturers. It consists in protecting a liquid from contact with a hot surface, by interposing between the two a layer of gaseous molecules. In glass works the spheroidal state of water is sometimes illustrated on a large scale. In making colored glass, such as ruby glass, in which gold is the base of the coloring agent, it is often necessary to remelt the charge. The pot of melted metal is emptied by ladling, and the melted glass is poured into water. A barrel of water is placed upon the floor near the opening of the pot, and the workman with an iron ladle pours the melted glass into the water. It at once sinks, and, owing to its intense degree of heat, becomes surrounded by an atmosphere, or thin layer of steam. The water does not touch it, and hence is but slightly heated. The surface remains quiet, and the depths of the water glow with a diffused red light. After awhile the glass cools, the water comes in contact with it, and bursts into rapid ebullition. Even this ebullition is less violent than would have been anticipated, owing to the non-conducting power of the glass. As soon as a small thickness becomes cool, it protects the centre of the mass. If a few ladles are emptied into a bucket of water, the effect is far more striking. The red-hot glass can be seen lying in a mass, as large as a cocoanut, quietly at the bottom of the pail. It is most impressive to see the great lump of glowing mass maintaining its full heat under the comparatively cold water. This state of things may last for a minute or more before the water boils.— *Iron.*

Chloride of Palladium Paper for Detecting Gas Leakages.— To search for leakages of gas, Dr. Bunte suggests the use of paper dipped in palladium chloride solution. Such a paper, in fact, changes its color as soon as it is in the presence of a quantity, however small, of gas, coming from leaks imperceptible by the odor, and which produce no effect upon the earth covering the pipes. Dr. Bunte suggests the following method of practically applying the test to street-mains. Above the pipe are excavated, at intervals of two to three metres (six-and-one-half to ten feet), holes thirty to forty centimetres (twelve to sixteen inches) deep, corresponding to the joints and sleeves. In each opening is placed an iron tube twelve to thirteen millimetres (one-half inch) in diameter, within which is a glass tube containing a roll of the test paper. The air from about the main enters the iron tube, and the trace of gas which may be present reveals itself by coloring the paper brown or black, according to its quantity. If, after ten to twenty minutes the paper is still white, we may be certain that at the point tested there is not the smallest escape of gas. Various authorities who have experimented with Bunte's method certify to its efficacy. Beyer, of Mannheim, Eitner, of Heidelberg, Richard, of Carlsruhe, the superintendent of the gas company of Stuttgart, may be noted among these. As a consequence of the trials made at Monaco, it follows that if the use of palladium paper is of incontestable use for testing outdoor conduits, it is of no less value in the case of leaks occurring within houses. Dr. Bunte admits this fact, but adds that in applying this reaction to places closed tightly, certain troubles present themselves. Thus, suspending a piece of paper saturated with palladium chloride to the ceiling of a gas-lighted room, only a small fraction of the air comes in contact with it. Now, to produce the coloration, a certain volume of gas is required. It follows that gas must form a considerable portion of the atmosphere to act upon the paper. Better results would be obtained by aspirating the gas through tubes containing it. Another trouble is that the paper suspended in the air dries and becomes less sensitive. Felker overcomes this trouble by placing under the glass tube a receptacle filled with palladium solution.— *L'Industria.*

Natural Cements. — These are produced from stones containing a large proportion of clay; they are generally found among the hydraulic limestones. Those containing about thirty per cent of clay yield a quick-setting cement, others having a smaller proportion yield a slow-setting one. These cements possess no great strength, and will not stand the weather; consequently, they are mostly used for internal plastering, for which purpose they are specially suited. Roman, Medina, Harwich, Calderwood, and Whitby cements belong to this class. Roman cement is made from stones, or nodules, as they are called, found in the London clay. They are burnt at a low temperature, and yield a very quick-setting cement, which is brown in color. This cement is the oldest in the market, and has been held in great esteem both for internal and external work. It has, however, been to a great extent superseded by Portland cement for outside use, and by others, both natural and artificial, for inside work. It has been much used for stucco, but the stones from which it is produced contain a large proportion of lime, magnesia, iron, and other foreign substance. These are formed into sulphates during the process or calcination, the principal being sulphate of lime and sulphate of magnesia, so that after the cement has been used the sulphates attract moisture and cause the surface of the wall to be damp in wet weather, and in dry weather to be covered with crystals like hoar frost. This is called efflorescence. From the readiness with which it attracts moisture, it should be kept in a perfectly dry place and closely packed till required for use. It should only be mixed in the proportion of one or one-and-a-half of sand to one of cement. This makes it a dear cement to use, as there are others which, though more expensive at first cost, are capable of bearing five or six parts of sand, and therefore produce a greater bulk of mortar at less cost. It is well adapted for repairing work, as it can be painted at once, while Portland cement requires twelve months before it is perfectly dry. The best quality of this cement should not weigh more than seventy-five pounds per bushel, and should set in fifteen minutes. Medina cement is made from the nodules found in Hampshire, the Isle of Wight, and the Isle of Sheppey. It is of a light-brown color, and sets very quickly, almost as soon as it leaves the trowel. It is the best material to use where a quick-setting cement is required. The other kinds of natural cement are very similar to those just described, both in their composition and general charateristics.— *Iron.*

Imaginative Art Renaissance. — It is with the fifteenth century that begins, in Italy as in Flanders (we must think of the carved stonework, the Persian carpets, the damascened armor, the brocaded dresses of Van Eyck's and Memling's Holy Families), the deliberate habit of putting into pictures as much as possible of the beautiful and luxurious things of this world. The house of the Virgin, originally a very humble affair, or rather, in the authority of the early Giottesques; a no place, nowhere, develops gradually into a very delightful residence in the choicest part of the town; or into a pleasantly-situated villa, like the one described in the "*Decameron*," commanding a fine view. The Virgin's bedchamber, where we are shown it, as, for instance, in Crivelli's picture in the National Gallery, is quite as well appointed in the way of beautiful bedding, carving, etc., as the chamber of the lady of John Arnolfini of Lucca, in Van Eyck's portrait. Outside it, as we learn from Angelico, Cosimo Rosselli, Lippi, Ghirlandajo, indeed, from almost every Florentine painter, stretches a pleasant portico, decorated in the Ionic or Corinthian style, as if by Brunnellesco or Sangallo, with tesselated floor, or Oriental carpet, and usually a carved and gilded desk and praying stool; while the privacy of the whole place is guarded from the noisy street by a high wall, surmounted by vases, overtopped by cypresses, and in whose shelter grows a row of well-kept roses and lilies. Sometimes this house, as I have said, becomes a villa, as is the case, not unfrequently with the Lombards, who love to make the angel appear on the flowery grass against a background of Alpine peaks, such as you see them rising blue and fairy-like from the green rice fields about Pavia. Crivelli, however, though a Milanese, prefers a genteel residence in town, the magnificent Milan of the Galeazzo and Filippo Visconti. He gives us a whole street, where richly-dressed and well-peruked gentlemen look down from the terraces, duly set with flowerpots, of houses ornamented with terra-cotta figures, and medallions like those of the hospital at Milan. In this street the angel of the Annunciation is kneeling, gorgeously got up in silks and brocades, and accompanied by a nice little bishop carrying a miniature town on a tray. The Virgin seems to be receiving a message through the window or the open door. She has a beautiful bed, with a red silk coverlet, some books, and a shelf covered with plates and preserve-jars. This evident appreciation of jam as one of the pleasant things of this world corresponds with the pot of flowers on the window, the bird-cage hanging up; the mother of Christ must have the little tastes and luxuries of a well-to-do burgess's daughter. The cell of St. Jerome, painted some fifty years later by Carpaccio, in the church of the Slavonians, contains not only various convenient and ornamental articles of furniture, but a collection of knick-knacks, among which some antique bronzes are conspicuous.— *Vernon Lee, in the Contemporary Review.*



HELIOTYPE PRINTING CO. BOSTON

CHURCH OF ST. MARY OF THE ASSUMPTION, BROOKLINE, MASS.

PEABODY & STEARNS, Architects

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXI. Copyright, 1887, by TICKNOR & COMPANY, Boston, Mass. No. 600.

JUNE 25, 1887.

Entered at the Post-Office at Boston as second-class matter.

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LA SEMAINE DES CONSTRUCTEURS gives some particulars of the burning of the Opéra Comique which are interesting. According to the accounts in the daily papers, the theatre was commonly regarded as fire-proof; but it seems that less than two weeks before the fire a member of the Chamber of Deputies inquired publicly in the Chamber whether the Opéra Comique was in danger from fire. M. Berthelot, the Minister of Public Instruction, in reply to the question, said that he was at the moment studying the matter, which had been called to his attention during the past winter. He had inspected the theatre himself, and had noticed that the exits for the spectators were far more convenient than those for the actors. Of these there might, in certain cases, be nearly four hundred on the stage at once; and, for at least half of them, the only way of escape in case of fire would be to cross the stage, above the proscenium arch, on a plank bridge about two feet wide. This state of things he regarded as highly dangerous, and if a fire should break out during a representation, there would probably be sad loss of life. He hoped that there might be no fire; but it was a fact, proved by statistics, that no theatre had ever gone through a hundred years without at least one fire, and sooner or later there would undoubtedly be one in the Opéra Comique. Thirteen days afterwards the prophecy came true. A fire broke out during a representation, and the unfortunate ballet-girls and chorus-singers were burned to death by the score, while most of the audience escaped. It is a little surprising, perhaps, that a public official should have been able to find anything wrong about such a building, but it is not less so that the Minister of Public Instruction should not have been able to give at once effective directions for remedying the dangers which he noted. An inspector of buildings in New York or Boston would, in such a case, have sent out orders for cutting new doors, and setting up fire-escapes, as soon as he could get back to his office, but in the case of the Opéra Comique not only were no new orders given, as it seems, but nothing was done to punish the open violation of the statute relating to such matters. All theatres in Paris are required by law to have a system of sprinkler-pipes over the stage, capable of inundating the scenery with water, and to have the stage separated from the auditorium by an iron curtain, which must be held up by a hemp rope, so that, if the employés of the theatre are too much frightened to lower it in case of fire the rope will burn off, and let it fall; but in the Opéra, although the curtain was in place, ready to lower, no one thought of attending to it; and it was held up by brass chains instead of combustible rope, so that it did not fall of itself.

PUBLIC interest has of late been so frequently directed to the Metropolitan Museum of Art of New York by the several contributions of great value which that fortunate institution has received from both living and dead benefactors that, perhaps, the citizens of other towns may be pervaded by a spirit of emulation and make now, while they are still in the flesh, those gifts to similar local institutions which many of them possibly intend that their heirs shall perforce do in their stead. There is just now a most excellent opportunity for such well-intending citizens of Boston to justify the cancellation of the clauses or codicils of their testamentary instructions — which we advise them to revise forthwith — by substituting for these bequests, which at some indefinite day might benefit the Museum of Fine Arts, contributions of ready money of which the institution is in great need. The Trustees of the Museum have just issued a public appeal for contributions of money which will enable them to proceed with the construction of another portion of the building, as originally designed.* We have mislaid their circular, but we believe that they have already in hand, secured by private effort, $282,000, and they seek to increase it to $300,000, so that they may not only build the portions of the east wing, of which there is such pressing need, but may secure casts and other material which form the stock-in-trade, so to speak, of a well-equipped museum. The present collection of casts, though reasonably full and complete in some lines, can be increased in value and thoroughness more easily and at less expense than any other collection of which the beginnings have been secured. So far as securing casts of the many "finds" recently made by the little army of explorers in various quarters of the world, which we understand to be the desire of the Trustees, there is, of course, a commercial advantage in placing an order so that it can be filled at the same time with the orders given by the various European Art Museums, more or less of whom are extending their collections in this line at every opportunity. None of the other collections can be increased so easily, satisfactorily and cheaply, except, possibly, the collections of books, photographs and engravings.

IT has been, but fortunately is becoming less, a common weakness of those who make gifts of funds to institutions of any kind to so prescribe and limit the object upon which the fund or its income may be expended as to seriously interfere with the growth of the beneficiary institution and its usefulness. The reason of this is that the benefactor, as a rule, seeks less to do good than to perpetuate his name and this one good deed — a deed which is generally accompanied by much heart-burning amongst his heirs, and not a few law-suits. Harvard College has been in these last few years unusually fortunate in securing contributions and gifts which can be expended for general purposes at the discretion of the President and Corporation. To a less extent, though perhaps to a greater degree, the Museum of Fine Arts has profited by that public spirit which is real and is not used to mask self-seeking notoriety. A portion of the building has been erected, and has been filled to overflowing with collections which have less chaff amongst them than, perhaps, any others in the country, and yet we believe no man's name has been tagged on to any portion of the building or, with one exception — and that an endowment made before the Museum was founded — to any official salary. Every one knows the names of the individuals who have in the largest degree contributed to the construction of the Museum and the formation of the collections, but these names are not paraded publicly, but will be preserved by tradition. Besides the chief contributors, there have been many others, and we believe that if the general public were approached in the right way, if they were made to feel that the institution is really for them and theirs, and not only for the elect few who can appreciate and enjoy *all* that is put before them, if they could be made to feel that their help would be valued according to the spirit in which it is offered, and not merely according to its amount, and, finally, if local pride could be stimulated, we believe that a popular subscription could be secured which would more than make up the sum the Trustees call for.

UP to this time the collections, while not being complete nor yet very full, have been gathered so judiciously that they afford a sufficiently-comprehensive glimpse of what a museum of fine art should contain. With the enlargement of the building, and the increase of funds, we may look for the expansion of collections already begun, and the acquisition of complete special collections gathered by individuals. The collection of Japanese robes, sword-hilts, bronzes, etc., which for several years have been loaned to the Museum by Dr. W. S. Bigelow, have given to a portion of one gallery a distinctively Japanese air. Perhaps these loans may in time become permanent possessions; meanwhile, they form a nucleus about which to

gather other Japanese work, and as the civilization of Japan is changing so rapidly, there seems to be good reason why effort should be at once made while prices are comparatively low to increase the collection of articles which for real art interest will probably never be excelled. If the collecting of Japanese work is to be entered on in the proper spirit of thoroughness, there is one thing that ought unquestionably to find a permanent place — a special room in the Museum — and this is Professor Morse's collection of pottery, which we described some weeks ago. This collection is as unique as it is complete, and, in consequence, it would be a costly possession to acquire, and the Museum can never hope to buy it — as we believe it willingly would — out of its own funds. If, then, the Morse collection is to remain in Boston, and not inflict a pang on local pride by being bought for the Museum at Cincinnati, or New York, or those greater institutions the British Museum or the South Kensington Museum, it must be secured to us by the generosity of individuals; and we trust they may be found in time. With a collection of such size and indisputable genuineness, the Museum of Fine Arts can well afford to leave the field of Cypriote research to the Metropolitan Museum of New York.

A SCHEME has been proposed for conveying railway-trains across the Alps, which, perhaps, surpasses the Tehuantepec Ship-Railway in novelty. For many years the merchants and manufacturers of Paris and the valley of the Seine have desired to secure a railway-route to Italy more direct than that by the Mont Cénis tunnel, or the Saint Gothard. Although the détour is not a very long one, the difference of a few miles makes itself felt in a close commercial competition, and the French seaports, as well as the inland towns, complain that the trade which would come to them if they were connected by a shorter route with Venice and Brindisi, now goes to Antwerp for transfer to the Saint-Gothard line. The most practicable line for a new link between the French and Italian railway-systems is now generally considered to be across the Simplon, and the roads on each side are already graded nearly to the entrance of the series of tunnels necessary to pierce the mountain. So far, however, it has been impossible to raise the money for constructing the tunnel itself, and the auxiliary lines bid fair to be separated by snow-capped peaks for many years yet. To relieve this perplexity, M. Agudio, the engineer of the rope-railway by which pleasure-seekers ascend the hill of the Superga, near Turin, has devised a plan for constructing a similar line over the Simplon group, adapted for the transportation of freight and passenger-trains, of which *Le Génie Civil* gives a description. Of course it would be impossible to have a single-rope line long enough to ascend even one side of the giants of the Monte Rosa range, and M. Agudio proposes to have a succession of them. Instead of using endless cables, constantly running, by which a car might, as in our cable-railways, be transported continuously over the whole length of the route, he divides the line into sections, entirely independent of each other, so that a car or a train must be disconnected from one and connected to the next before it can proceed. At a speed of seven miles an hour, it would take about two hours and a half to cross the mountain, including the changes, and M. Agudio calculates that he can transport a train weighing one hundred and forty tons.

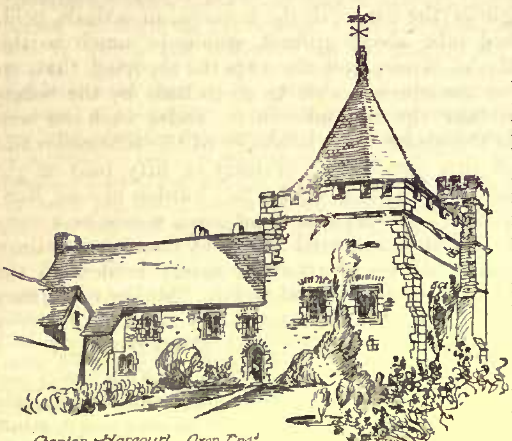
SO seriously has this plan been urged by M. Agudio and his friends that a commission of experts was appointed by the railway companies and financiers interested in the route, to examine into its practicability, and see whether it would be worth the eight million dollars at which a firm of contractors stood ready to undertake it. The greatest difficulty in the way of operating a surface-railway over so high a mountain would naturally lie in the accumulation of snow, and the experts considered first the means by which this difficulty was to be overcome. In brief, these means consisted in the construction of a tunnel above ground over nearly the whole length of the road, the shelter consisting of sheet-iron in places where no avalanches were to be feared, and of masonry in the "*couloirs*" down which snow would be apt to slide. The experts, naturally enough, found this arrangement decidedly objectionable. To say nothing of the want of permanence of a sheet-iron enclosure in the region of glaciers and eternal snow, the darkness and closeness would be very disagreeable to passengers. Although travellers generally dislike tunnels underground, the comparison between the passage of the Saint-Gothard tunnel, which is traversed by through trains of comfortable, brilliantly-lighted sleeping-cars in about half an hour, and a transit of two hours and a half, with frequent stops, changes, and shiftings of the angle of the car with the horizon, in a dark, cold, and unventilated tube above ground, would be much to the disadvantage of the latter, and the experts reported that, in their opinion, no one who was able to go to Italy by the Saint-Gothard would take the Simplon route under such circumstances. As to the general practicability of the scheme, while they considered that small loads of forty or fifty tons might be dragged over the mountain safely, the burden of one hundred and forty, which M. Agudio mentioned, would be a very different affair, and they reported that they could not believe that such a load could be at all times safely hauled up the pass, and still less lowered on the other side. Moreover, as they pointed out, by an injury to the track, such as would be very likely to occur in the case of a line laid along the flank of a steep mountain, exposed to the avalanches of winter and the torrents of spring, the derailment of a train would precipitate it into depths from which it could never be recovered, while the repairing of the track would be a long and difficult task. For all these reasons the Commission has now pronounced decidedly against the plan, which it calls impracticable, dangerous, inadequate, and unsuitable to a great international route.

PLUMBERS, as well as architects, will be interested in the account given in the *Deutsche Bauunternehmer* of a novel method for thawing the ground, as a preliminary to excavation in winter. Instead of building a fire over the spot to be excavated, as is with us the ordinary practice, those who use the new method spread over it a layer of quick-lime, followed by a stratum of snow. More lime is put on, and this again covered with snow, and if the ground is frozen to a great depth, several alternate layers are used. The whole is then left to itself over night, and in the morning the ground is found to be free from frost. If no snow is to be had, water may be used for slaking the lime, which is then to be covered up to keep in the heat.

PROFESSOR R. H. THURSTON, of Cornell University, exhibited before the recent Convention of Mechanical Engineers a very large blue print, measuring three-and-one-half feet wide, by eight feet long, which was made by a new process. It is evident that to print such large drawings in a frame would be almost impracticable, while the weight of the glass would make the handling very difficult, so it occurred to Professor Cleaves, of the University, to evade the inconveniences of the ordinary process by dispensing with glass, and wrapping his sensitive paper, with the tracing to be printed over it, around a smooth cylinder, holding the whole in place with spring clamps. By turning the cylinder in the sunshine an even impression is produced, and the contact between the positive and the negative is far more perfect, and the print consequently clearer, than with large sheets of plate-glass. Perhaps architects have as much occasion as any one to make large blue prints, and a cylinder apparatus of the kind would be much cheaper and better than a frame of more than the usual dimensions.

LE GENIE CIVIL describes a new method for the artificial preparation of spinel rubies, which may have some interest for students of chemistry. The spinel ruby differs from the precious ruby in being composed of about one part magnesia to three parts alumina, instead of pure alumina; but it derives its color from an admixture of chromium, in the same way. The principal difficulty in imitating rubies has been the uncertainty of the color, the metallic salts used for coloring being often reduced in the crucible, instead of dissolving in the hot alumina, and the new process, which is due to M. Stanislas Meunier, guards particularly against this trouble. A black-lead crucible is furnished with a lining of pure magnesia, very finely ground and well packed down, and is then partly filled with a mixture of chloride of aluminium and cryolite, the natural fluoride of aluminium. A little bichromate of potash is added, and the crucible is then filled up with a mixture of alumina and magnesia, the magnesia being in excess. After five or six hours in a strong fire, the crucible is allowed to cool very slowly, and is found to contain a grayish mass, which, when broken, shows cavities lined with extremely brilliant pink crystals of spinel ruby. The crystals are very small, and we believe that no scientific man has discovered the secret of the Geneva manufacturers of real rubies of commercial size.

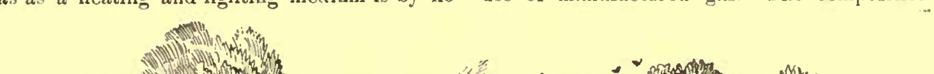
THE PITTSBURGH NATURAL-GAS SUPPLY.



Stanton Harcourt. Oxon Eng.d "The Abbot's Kitchen" from sketch by W.H. Pite London Eng.d

OF all the marvels which this wonderful nineteenth century has evolved, there is hardly anything which is so interesting in its nature, so wonderful in its power and so revolutionary in its character as the employment of natural gas as a medium for heating and lighting. There is something almost supernatural about the idea of probing into the tremendous forces of nature and harnessing them to work for us in factory and shop, to cook our food, light our houses and heat our rooms. It seems like playing with nature to thus snatch her secret forces from her, drawing, as it were, the very life out of her inner being, trusting so completely her exhaustless bounty, as to be willing to commit one's self to the extended systems of piping and intricate appliances such as are involved in a natural-gas plant, even though the supply be so unknown in its quantity and so capricious in its action. This has been a century of fearless investigation and daring ventures, but it is doubtful if anything could exceed the confident, almost reckless manner in which money has been invested in this new industry.

And yet, natural gas as a heating and lighting medium is by no means a novelty. The Chinese have been using it for centuries, and there are wells in China from which the gas is still drawn through bamboo pipes and burned at clay burners. And in Persia the fire from natural gas-wells has nearly always been an adjunct to the places of worship. In this country, also, natural gas is by no means a recent discovery. Any one who is at all familiar with the geological formation of the United States will remember that the whole of the west-central ranges of the Alleghanies, as well as the greater portion of the Mississippi Valley, north of the Ohio, at least, are underlaid with vast coal strata of varying quality, from the hard anthracite of Pennsylvania to the soft, smutty, bituminous coal of Illinois. It by no means follows that wherever coal exists natural gas can be found, and yet it is a fact that all the gas-wells have been found in the region of the coal-deposits, and that throughout the whole of the Mississippi Valley there are more or less signs of gas. In Illinois, at one place we know of, natural gas has been used for heating and lighting for thirty years, and at another place in Ohio a supply was found many years ago which is still made use of in a small manufacturing establishment.



An old House nr Guilford. Surrey. Eng.d E.E.D.

But the application of natural gas to the wants of a busy manufacturing city is a thing of quite recent date. In 1875, Spang, Chalfant & Co., iron manufacturers of Sharpsburg, Pa., began to use natural gas in their furnaces with such good results that public attention was called to it, and about four years ago the scientific world was astonished by the announcement that the city of Pittsburgh was about to be supplied throughout with natural gas. It is hard to appreciate all that the use of such a medium would involve: the miles upon miles of pipe, the vast reservoirs and the millions of dollars of capital necessary to place the fuel within reach of the consumers. The promoters of this scheme have undoubtedly had unlimited natural resources at their command. Thus far, certainly, there has been no reason to doubt that the supply of gas is practically unlimited. Even should the gas at some near day give out entirely, or be so reduced in pressure as to render its use impracticable on the scale on which it is now employed, there is another possibility which has been brought to the notice of Pittsburgh people, namely, that gas itself, as a fuel, being superior to anything else at present known, can, if necessary, be manufactured in sufficient quantities to meet the demand, and still cost less to the consumer than the price now paid for coal. One of the most difficult problems in connection with coal-mining is to dispose of the refuse which is piled up in all directions about the pit's mouth, becoming a source of discomfort to the whole country, as nothing will grow on the heap, and thus far nothing can profitably be done with it. But this very refuse which is worth nothing to any one — indeed, most of the mine-owners would be glad to get rid of it and pay for the carting — this refuse may be used in the manufacture of gas, and the great companies who have undertaken to supply Pittsburgh with gas claim that when the time does come that the natural-gas supply gives out, they will simply build retorts and deliver manufactured gas to the consumers at a slight increase over the present cost of natural gas.

It is not our intention to go into details of the gas-plant any farther than is necessary to understand the way in which the fuel is supplied to the people. There are a number of companies engaged in this enterprise at Pittsburgh, each company having the control of a great many wells, the supply being sometimes drawn from as great a distance as thirty or forty miles. The gas issues from the wells at a pressure varying from three to eight hundred pounds per square inch. It is collected in large wrought-iron mains laid over hills, under rivers and across ravines, to the city, being regulated in pressure by special valves until it reaches the consumer at a pressure not over fifteen pounds in the distributing-mains, and not over four to five in the house-service-pipes. Details of piping would hardly interest the general reader, as they differ with the different companies and after all are essentially the same as those adopted for the use of manufactured gas. The composition of the gas varies, of course, in the different wells, but generally speaking, it is composed of twenty-two per cent pure hydrogen, sixty-seven per cent of carburetted hydrogen, the balance being carbonic acid, oxygen, nitrogen and various other gases in small proportions. It burns with a bluish flame, giving comparatively little heat and almost no light when taken in its natural condition, but when mixed with from eight to fifteen times its volume of ordinary air, it burns with a high temperature. Its specific gravity is a little more than half that of air and its explosive force is less than that of coal gas. Natural gas explodes when mixed with nine volumes of air, while coal gas explodes with but six.

In using the gas the rule seems to be to obtain the heat by radiation from some non-combustible medium. In Pittsburgh stoves are used but little for heating, as the climate is quite moderate, open-grates being almost universally adopted. The common method is to lay a pipe to the under side of the grate, which is filled with broken fire-brick or bits of burnt fire-clay. The gas delivers in the midst of the grate, and on being lighted speedily heats the fire-brick to a white heat. Under such conditions the heat radiates very freely, though it is quite noticeable that the gas seems to give very little heat when it has nothing to act against.

The forms of burners adopted are very varied. In general, however, they agree in possessing the main features of the well-known Bunsen burner, which has a chamber beneath the outlet freely supplied with air from all sides.

When the natural gas is used in stoves for cooking purposes, a number of compound burners are used which spread the flames and allow the air to mix more freely with the gas, at the same time diffusing the heat more evenly. These are only a few of the many forms made use of. There seems to be no definite rule, and an engineer of one of the large companies told the writer that the whole

matter of burners was still in so formative a state that no one burner had as yet been recognized as preëminently the best. The consumer is at liberty to adopt any burner he pleases, the companies making no restrictions in this respect. The fuel is so simple in its nature that, after all, the main object is to burn it in the grate or the stove without danger to the consumer, and the cost is so exceeding low that it is a matter of very little consequence to the consumer whether he gets the best use of his fuel or not. It seems almost fabulous that for $15 to $20 a year a man actually can light and heat his house and do all of his cooking, and yet that is about the average cost in Pittsburgh for household purposes.

We extract from the Philadelphia Company's hand-book a few rules and directions in regard to the use of natural gas, which will be of interest in this connection:

"In no case shall a fire-test be used in dwellings, offices, stores, etc. No cement of any kind shall be used for repairing faulty fittings or work; nor is the use of *blind gaskets* permissible.

"When any attempt to hide leaks is made, the name of the fitter will be kept on record at this office, and future work done by him will not be approved without rigid examination.

"In running pipes in buildings, no set rules can be given, except that pipes must in all cases, when possible, be so placed that they can be easily inspected; and that in case of accident any leaking gas may escape easily.

"Cement wall carefully where service-pipe enters the building, and use a large pipe for the main that runs through the cellar. Provide valves to shut off gas from all risers. In running pipe through flues great care is necessary, and lead pipe for the bends should not be used.

"Do not run pipes between floors or walls when any other method can be employed. Do not place cocks between floors and ceilings. Do not use any valves which require packing at the stem in places where leaking gas may be dangerous; if pipes run outside of walls, provide a drip.

"*Get a good plumber.*

"Large pipes are the best. Galvanized fittings only should be used. Wherever it is possible, pipes should be put up flues, and under no consideration should they be placed inside of partitions or cupboards. A leaky joint may allow gas to accumulate unnoticed for days, and when it comes in contact with a flame an explosion will follow. Stop-cocks should not be placed between floors and ceilings, where they may leak without detection for some time, and where they are difficult to get at in the event of repairs becoming needful. Pipes had better be directly under the grate, with an extension-bar to the outside of the fender, where the key can be attached when required. No cement joints will be permitted. Pipes must stand a pressure of ten pounds to the inch.

"To make everything safe, have all holes around any pipes which enter the cellar carefully stopped with cement on outside and inside. Tamp the earth around water-pipes and sewers very firmly, to prevent any leaking gas from following the pipes, as it may do if the earth is loose around them."

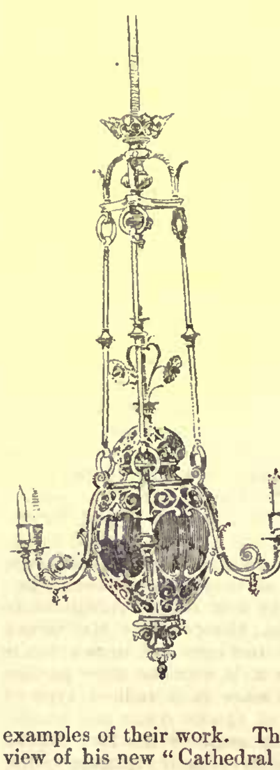
In regard to piping, the natural-gas companies require the consumers to make and pay for all connections from the mains to the burners, but the work must be approved by the company's inspector.

The use of the gas for steam boilers is, if anything, more extended than is its use for household purposes. The gas is introduced under the grate, and the commonest and perhaps the best way is to deliver it from the pipe into a central chamber, built up with fire-brick under the boiler, where the gas can mingle with air and burn against the non-combustible material, thus evolving a greater degree of heat than would be possible by simply burning the gas freely under the grate. There is no smoke from this fuel, no waste, no ashes; a turn of the hand and the full combustion is obtained; another turn and it is stopped instantly, without any preliminary in stopping and starting, as causes such a waste or loss in the use of coal. The heating powers of the gas are far superior to those of coal. Aside from the loss in the latter fuel in stopping and starting a large furnace, experiments have demonstrated the fact that eighty-two pounds of Pittsburgh coal will heat no more space than a thousand feet of gas. Practically a thousand feet of gas is equal to much more than a hundred weight of coal, on account of loss and waste of fuel.

The natural gas is not a success as an illuminating medium, at least not when taken in its natural state. It is so weak in carbon that it burns with a very blue flame, emitting very little light, and even with the best of the many burners which have been invented for the purpose the amount of light cannot compare very favorably with that given by artificial gas. Although the gas has been introduced into Pittsburgh on so gigantic a scale, and is used so freely in the city, it does not seem to have interfered with the use of the artificial gas, if we may judge by the stock-market, for Pittsburgh gas-stock appears to be as much sought after as it was before natural gas was introduced. There are, however, possibilities by which the natural gas can be utilized quite successfully. Some forms of carburetters have been employed, such as are used in the manufacture of gas from naphtha, the natural gas being passed over the naphtha, drawing from it the constituents of carbon which are needed to enable it to emit the strong yellow light suitable for illuminating purposes. By this process, also, the gas acquires an odor which enables one to readily detect any leak, natural gas having almost no odor at all, and hence, to a certain extent, being dangerous to use in open burners. There is, however, another objection to natural gas which we imagine is a serious barrier to its adoption for illuminating purposes, namely, the pressure from the natural-gas mains is, of a necessity, considerably higher than is ever put on the manufactured gas, and burners supplied with natural gas give a very flickering, unsteady light, trying to the eyes, and in every way unsatisfactory. Natural gas is, nevertheless, used a great deal in Pittsburgh for illuminating on account of its cheapness, and the people completely obviate any possible danger from gas explosions due to an open crack or neglected burner, by leaving the gas burning all the while, day and night. It is so cheap that they do not even take the trouble to turn it off. But its use is confined to street venders, cheap shops and factories where full illumination is not required, and in a few instances it has been used, to a certain extent, for street lamps, though with doubtful success.

The change which the use of natural gas has made in Pittsburgh is something which must be seen to be appreciated, and then one will not have a full idea of the change unless one has had the misfortune to pass several days in the city in the days of old, when natural gas was not known, when the sun shone not at noon, and street lamps gave an uncertain glare at night. Now the atmosphere is as clear as could be expected in any city of its size, and a visitor to Mt. Washington can look over the whole country, embracing both sides of the Monongahela and the Alleghany and far down the Ohio; something which would have been utterly impossible six years ago. Neither is this the only change. It is possible to have clean clothes and a clean house, whereas before the air was full of soot and the very houses seemed impregnated with dirt from the air. It is no wonder that the people take pride in their new application and have full faith in its durability. It has made it possible for them to have a beautiful city, and at the same time to continue the industries which have created their fortunes, for the gas is used alike to heat a chamber or to melt a ton of iron; to drive a steam engine or to manufacture glass. How extended its use will become throughout the United States is, of course, a question. There has been talk of laying a line of pipe from the gas region in Pennsylvania to New York, but we hardly think it would be possible to preserve the pressure necessary to make the gas available at that distance. The numerous gas-wells scattered through the Mississippi Valley west of Pittsburgh are under such feeble pressure that they are of little practical value, and while the area of available gas-wells is being increased every month, and new reservoirs are being added to the stores of the companies, it seems hardly possible the use of gas as a fuel can ever be extended beyond Pittsburgh and its suburbs. But, as we said before, natural gas may prepare the way for the manufacture on a larger scale than ever before of artificial gas made from the refuse coal, which would bring this new, cheap and serviceable fuel within the reach of every one, and would make it as possible to use gas in Boston as it is in Pittsburgh.

ARCHITECTURE AT THE ROYAL ACADEMY.



THE interest of the architectural-room is this year of a very mixed character. In one way it is full of interesting drawings, in another, as representing the architecture of the year, or even of the time, it is somewhat disappointing. Of the members of the Academy, three only send one drawing each, and one, Mr. Bodley, none at all in his own name, so, whatever may be said of the other rooms in the Academy, here at all events, the outsiders seem to have it all their own way. The works may be roughly divided into three classes, about a third are ecclesiastical, another third domestic, and the rest student's drawings and drawings of old work. Some of the latter are of great interest, but the space allotted to them is rather overdone, especially considering the limited size of the one room given up to architecture at Burlington House. Some of them, at least, might have been very well spared and their places occupied by works more representative of architecture recently carried out. Two of the architectural Royal Academicians send diploma works deposited by them on their election as academicians. These are always interesting as showing us what their authors themselves consider most characteristic examples of their work. Thus Mr. Pearson gives to the Academy a view of his new "Cathedral at Truro." It is taken from the north-east, and shows the choir with its transept, the north transept, the great central tower, and the chapter-house. The design is so well known that it is unnecessary to speak in detail of it here. Suffice it to say that it is full of all that is best in Mr. Pearson's work, charming in proportion, strong and yet delicate in detail, wonderfully picturesque in its grouping, and so like a bit of old Gothic that in a few years it will be hard to tell the difference. The drawing is exquisitely rendered in pen and ink; some old houses in the foreground of the picture, very cleverly managed, seem to impart the

air of a by-gone time, so that the whole reminds one more of some ancient cathedral than of one not yet opened.

Not so, however, can anything of this kind be said of Mr. Waterhouse's diploma drawing of "Manchester Town-Hall." There will never be any doubt of its having been built during the Gothic Revival of the nineteenth century. It is so thoroughly characteristic of that revival and of our time that the future historian will doubtless feel thankful to have his mind set at rest on the point at the first glance. It is an admirable example of its author's work, both as an architect and a water-colorist. It has all those distinguishing features for which he is famous, and having been built before the rage for terra-cotta set in, is probably the best example of his skill the Academy could have. The drawing is in water-color and shows the building under the warm glow of sunset. Mr. Waterhouse also contributes "Girton College, Cambridge," — a red-brick composition, with some half-timbered gables and a massive gate-tower, but it does not look like Cambridge, all the same. The fair girl-graduates may by this time be acclimatized to the old University town — it is to be feared it will be a long time ere architecture of this sort becomes so. On the other hand, "The Royal Infirmary," Liverpool, looks like its work and the place. It is to be noticed in this and other hospitals shown in the room how much the circular ward is coming into use — a feature of which a good deal is to be made by a clever architect.

Above Mr. Pearson's "Truro Cathedral" is hung (too high) a beautiful water-color drawing of the interior, looking east, of Messrs. Bodley and Garner's design for the Liverpool Cathedral. It shows the effect of the large central octagon, and very fine it is at that. Apparently, the interior of the church was intended to be in the red-stone of the district, as the architecture is very warmly colored. It is almost an exact reproduction of old work, so much so that, as in Mr. Pearson's case, it is hard to tell the difference, for, in truth, it is quite equal to any old work ever done. It is in fourteenth-century Gothic, admirably detailed, and full of the old mediæval feeling in every line. One is surprised there are not more drawings from this important but, up to now, unsettled competition. The movement for getting the whole of the drawings exhibited in London seems to have come to nothing, therefore one would gladly have seen more of them in the Academy.

Mr. Norman Shaw sends but one drawing and that not by his own hand. It is the "New Central Offices for the Metropolitan Police," about to be built on the Thames Embankment. This is more than usually interesting, as it is about the first public building of any importance Mr. Shaw has been called on to design. He has treated it in free Classic, in a broad, dignified manner, simple in mass and outline. The fronts have circular angle-turrets, with a similar turret in the centre of the flank, running up above the main cornice and covered with conical roofs. The rich main cornice abuts against the rounded sides of these turrets and the main roof of the building is continued behind them — nothing else breaks the lines of the building. The two lower stories have simple windows with quaint outside shutters, Dutch fashion. Above, the fenestration is richer in detail, the windows having pedimented heads. The doorway is in the return flank and seems almost too small and commonplace for such a building. It is a wide, circular-headed opening, with small pilasters on each side after the manner of Messrs. Barings' Bank by the same architect, in the city, and has a figure of Justice in a niche within the broken pediment. This, with a crown and a V. R. carved on the angle, is all that indicates the purpose of the building. Much of its life and effect will, of course, depend on the quaintness of its detail, and Mr. Shaw may be trusted to give us something much more interesting than the ordinary Classic of the schools.

The remaining Associate, Mr. George Aitchison, sends a drawing of the decoration of a drawing-room at Grosvenor Crescent. In this connection, also, may be mentioned the drawing of the grand piano designed by Mr. Alma Tadema for the same New York music-room for which the President painted the ceiling and frieze exhibited last year. Mr. Tadema has designed all the furniture of the room in a kind of Neo-Grec style, and this piano is made to harmonize therewith. It is a wonderful piece of work, full of wonderful detail in all manner of precious woods, ivory, mother-of-pearl, etc. The general design of the case and the decoration of the top is very good, but the feet are far too massive, a fault which may also be applied to the metal music-rest. The pedal-frame is fashioned of two Greek Doric columns with an entablature over them, all very neat and complete.

Taking the numbers as they come, the first is the "Additions to the Head Office of the Commercial Bank, Glasgow," by Mr. Sidney Mitchell. It is very striking in its way and very well drawn, but it has no connection whatever in feeling or style with the older portion of the Bank built a number of years since in a refined type of Classic. The additions savor strongly of Queen Anne and consist principally of an octagonal tower at the angle of the two streets. Under this tower is an open porch forming the new entrance to the Bank. The new work should certainly have been made to harmonize with the old.

"The Welsh Chapel," Shaftesbury Avenue, by Mr. James Cubitt, has some originality about it, like most of Mr. Cubitt's work. The interior seems to be chiefly lighted through a central lantern covered by an openwork kind of crown — a very effective feature, which should serve to distinguish this small church from its surroundings. The style is Early English. Again, in conjunction with Mr. J. M. Brydon, Mr. Cubitt sends an interior of their new Congregational Church at West Kensington — a large church roofed over in a striking manner by brick arches carrying a series of wooden domes over every bay in a highly original and picturesque manner. This church is also Early English and seems very well carried out.

Close to these drawings hangs the first of Mr. Graham Jackson's contributions, "The New Quadrangle and the House for the President, at Trinity College, Oxford." The others are "The New Front and Gateway-Tower in the High Street for Brasenose College, Oxford," some decoration and furniture for St. John's Church, Hampstead, and new churches at Stratton and Northington in Hampshire. The work at Oxford is what we usually get from Mr. Jackson, thoroughly in keeping with the place, picturesque in treatment, and careful in detail, its principal features being cleverly-designed bay-windows, gables and chimney-stalks. Exception must, however, be taken to the new gateway-tower for Brasenose. We hardly think it worthy of, or likely to add to the attractions of the famous High Street. It is a square tower, with an openwork crown after the manner of St. Nicholas's Church, Newcastle, only not nearly so good; in fact, it looks like a rather weak imitation of the similar kind of tower at Wren's Church of St. Dunstan in the East, London, and its detail seems to be of the same species of Gothic — or should it be written "*Gothick*" as more nearly conveying an idea of its type. As shown in the drawing, it is unworthy of the High Street and of Mr. Jackson. His two churches are picturesque village structures, with a good deal of flint-work decoration externally. One of them has an apsidal east end, not very English-like, but the towers of both are quaint and country-looking.

Mr. James Brooks sends his competitive design for St. Paul's Church, Kensington, a noble, Early English interior, vaulted in wood, and with a very fine square east end; also a drawing of his "Church of the Holy Innocents," Hammersmith — a large, cheap church, with a broad nave, double transepts, and the aisles mere passages—a bald-looking church, in very early Gothic.

The Parish Church, at Haydock, Lancashire, designed by the late George Smith, and carried out by Messrs. Douglas & Fordham, of Chester, is another charming village church, with a simple, effective tower. Messrs. Douglas & Fordham also send a church of their own at Colwyn Bay in North Wales, much the same type (Early Decorated) as the last-mentioned church. It has a fine, sturdy northwest tower, and is, altogether, full of character. The drawings which illustrate these churches, in sepia color, are very effective and are treated with great breadth of effect. The same remark applies to the drawings of two country houses by Messrs. Douglas & Fordham, one called "Abbeystead," in Lancashire, and another in North Wales. They are both of the same type of late domestic Gothic; the former sadly wants a plan to explain its arrangements. It looks almost like two houses built at different times. The entrance, with the staircase-window and a fine bay-window adjoining, are most effectively treated — thoroughly good English work.

Among country architects none are better known than Messrs. Burnet, Son & Campbell, of Glasgow. Their contributions fully keep up their reputation. The first to be noticed is their competitive design for the Coats Memorial Church, Paisley — a noble church in Early English, or, rather, the Scotch version of it, with an admixture of French feeling in the fine tower and spire. They also send drawings of the additions and clock-tower to the Clyde Trust Buildings, Glasgow. The latter is shown in two drawings, one of geometrical elevation, nicely executed, and the other by a most charming water-color, by Tessore. The latter is quite a river-side study, wherein the architectural is merged in the pictorial, the tower, as here treated, reminding one of some quay in the low countries, with the shipping and the water in the foreground.

The additions, in the shape of a new wing and an additional story, to the old Queen Anne Town-Hall at Carlisle, by Mr. Charles J. Ferguson, are very cleverly managed, thoroughly in keeping with the old work, with which it looks all of apiece. The new municipal buildings, at Sunderland, by Mr. Brightwen Binyon, are not nearly so happy. They are commonplace, flashy Classic of a French type. What can French Classic want in an English country town? Very different in feeling is the work at "Chelsea Town-Hall," by Mr. J. M. Brydon, of which three interior views are here shown. This is English Classic, thoroughly in harmony with the history of the well-known suburb, on which some recent articles in *The Century Magazine* gossip so pleasantly and illustrate so delightfully.

St. Nicholas Church, Newcastle, has recently become the cathedral of the new diocese, and Mr. Robert J. Johnson sends a drawing of the interior of the choir, showing the magnificent new reredos, bishop's throne and choir-stalls he has designed for it. The space looks rather narrow for a cathedral-choir, but Mr. Johnson has made up for this by the grandeur of his work. The reredos, full of sculptured figures and splendid canopy-work, fills the whole of the east end up to the springing of the great east window, the tracery of which only appears above the new work. The whole of these fittings are in fourteenth-century Gothic, beautifully detailed, in every way worthy of their place and able to hold their own against any work anywhere. The stalls and the throne are most elaborately carved, the canopy of the latter rising to a great h ight and forming a notable feature in the picture. The drawing is also very well executed in pen-and-ink.

Thirty-one, Hertford Street, Mayfair, is a clever town-house by Mr. Wm. Flockhart. It is in the Queen Anne style, and shows what can be done by a clever architect in such a limited space as the size of this house. The hall is made an effective feature, and the dining-

room behind it is lighted in a novel manner through the ceiling. Two very effective drawings show how it is all done, and that the front is in red brick with the usual cut-brick pilasters, bay-windows, etc., in the true spirit of the style.

A large block of buildings is in progress just now at the corner of Arlington Street and Piccadilly, with a return front facing the Green Park, from the designs of Mr. Wm. O. Milne. The drawing sent shows the portion facing the Green Park and Piccadilly in a free Classic treatment; windows with stone mullions, ornamental gables and tall chimney-stalks combine to make up a picturesque group. The shop fronts towards Piccadilly, are enclosed by the large semi-circular arches with *voussoirs* alternately in stone and brick, which seem to have become the fashion since Mr. Shaw first did them in the Assurance Building in St. James Street.

Mr. John D. Sedding is one of the most original of our church architects; his work is always interesting. This year he sends an interior view of the Church of the Redeemer, Clerkenwell, an exterior bird's-eye view of All Saints' vicarage, Plymouth, and a charming gate-lodge at Hete, in Devon. The former is remarkable for its plan — a wide nave, or, rather, a central area, separated from the aisles by freely-treated Corinthian columns and covered by a vault. The light evidently comes from the west end, and from circular clerestory windows in the arches of the vaulting. The altar is under a baldachino. The whole effect of the interior is that of an Italian church or convent-chapel. The columns just noticed are built in alternate courses of probably red and white stone, producing rather an unhappy effect. The other details, such as the balustrades, woodwork, etc., have all a certain quaintness in their treatment, which is quite a relief from the ordinary Classic version of such things. The vicarage is somewhat forced in its picturesqueness, but the little gate-lodge is a gem.



Mr. John Belcher sends a "garden view" of the exterior, and an interior perspective of the hall of "Morden Grange," an old, English-looking house, surrounded by prim, Dutch gardens, with their cut yew hedges, formal flower-beds and wooden garden-seats, all arranged in the most orthodox manner — quite a bit of old Dutch William's days revived for our modern eyes; all very pretty and quaint, but how are they to be got? Years and years must pass before such hedges could grow into the forms here shown; perhaps they are among "the provisions" in the contract for the "new, old-fashioned house"!

Near this is another triumph of the "revival" in the shape of a new wing and tower to the High School, Stirling, by Mr. J. M. McLaren. This is a genuine bit of new "old Scotch" — very clever, indeed; full of the spirit as well as the letter of the old work, and yet it is no slavish copy, but a capital piece of work all through. The tower stands solidly on the ground, and blossoms out into the richness of corbels and battlements and gables at the top, just as its old Scotch prototypes did.

An interior of the "Queen's Hall" of the People's Palace, recently opened by Her Majesty, is exhibited by Mr. Edward Robson. This is an outline drawing in brown ink, of an elliptically-ceiled hall, rather low in proportion to its width and not at all striking as a work of art; hardly a "Palace of Delight," architecturally considered. Liberal use seems to have been made of the details of St. George's Hall, Liverpool. The main ribs of the panelled ceiling are exactly like those in the great vault at St. Georges, and the gallery-fronts, with their caryatide supporters, are reproductions of those round the beautiful concert-room in the great Liverpool Building. They don't seem improved, however, by their change of venue to the east of London. It's not so easy to copy a good thing, apparently, after all.

Mr. Edis sends a clever drawing of the Constitutional Club, but we had a similar view of the same building last year. In addition, he sends a view of "Byrkley Lodge," Staffordshire, a large and important country mansion, in the old English style with which we are familiar from Mr. Edis — very well carried out and with very good results.

Lower Ince Church, Wigan, by Messrs. Paley & Austin, of Lancaster, is another characteristic church, with a wide nave, double transepts and a vaulted chancel — Early English in style and admirably detailed, except the heads of the east windows which, in the inside, are stilted in the most unpleasant manner; over the crossing is a continental-looking *flèche* which looks very un-English, and the north porch has its roof hipped back instead of a gable — not an improvement. The chancel-arch comes between the double transepts, so that one of them is in the nave and another in the chancel, the vaulting of the latter being continued across it. The meeting of the arches is very well managed indeed.

Mr. Lockwood, of Chester, sends a view of his church at Rogerstone, Monmouthshire, another good village church in the style of those by Mr. Douglas, already noticed. Those Cheshire men seem to have got into a style of their own for country churches, especially in Wales. It extends even to the drawings in brown color which represent them. Next to the last, but being too high, is a very good student's "Design for Assize Courts for a Country Town," by Mr. Hubert Westell. It is very well drawn, in good proportion, and in that phase of Classic so thoroughly English, that one feels it is the most suitable, both for its purpose and locality.

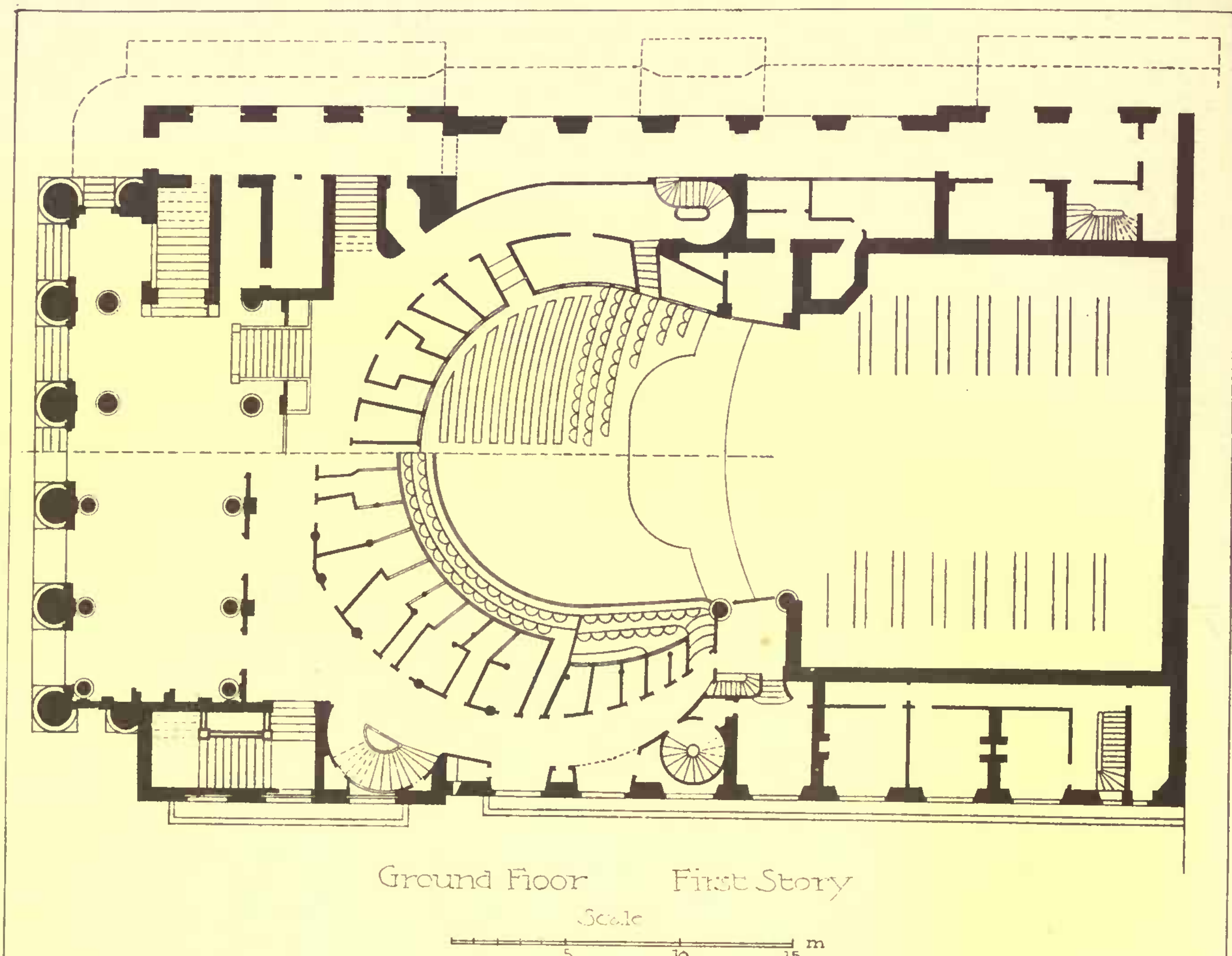
Mr. Basil Champney's work is always thoughtful and interesting — though sometimes uncertain — passing his "St. Bride's Vicarage," which was here last year, we have three drawings of the coming "Mansfield College," Oxford, and two of the "Church of St. Mary, Star of the Sea," Hastings. The College is for the Nonconformists, and will certainly be about the best bit of architecture they possess. In the late Oxford type of Gothic, full of interest and admirable in detail, it may fairly hold its own against any recent work there: more than this, it will be no unworthy addition to Oxford's wonderful group of colleges. Special features are made of the chapel, with its beautiful porch, the hall and the library. The quad is rather long and one-sided, but we presume this is the fault of the site rather than the choice of the architect, who seems to have made the most he could of the ground at his disposal. The chapel is particularly well studied.

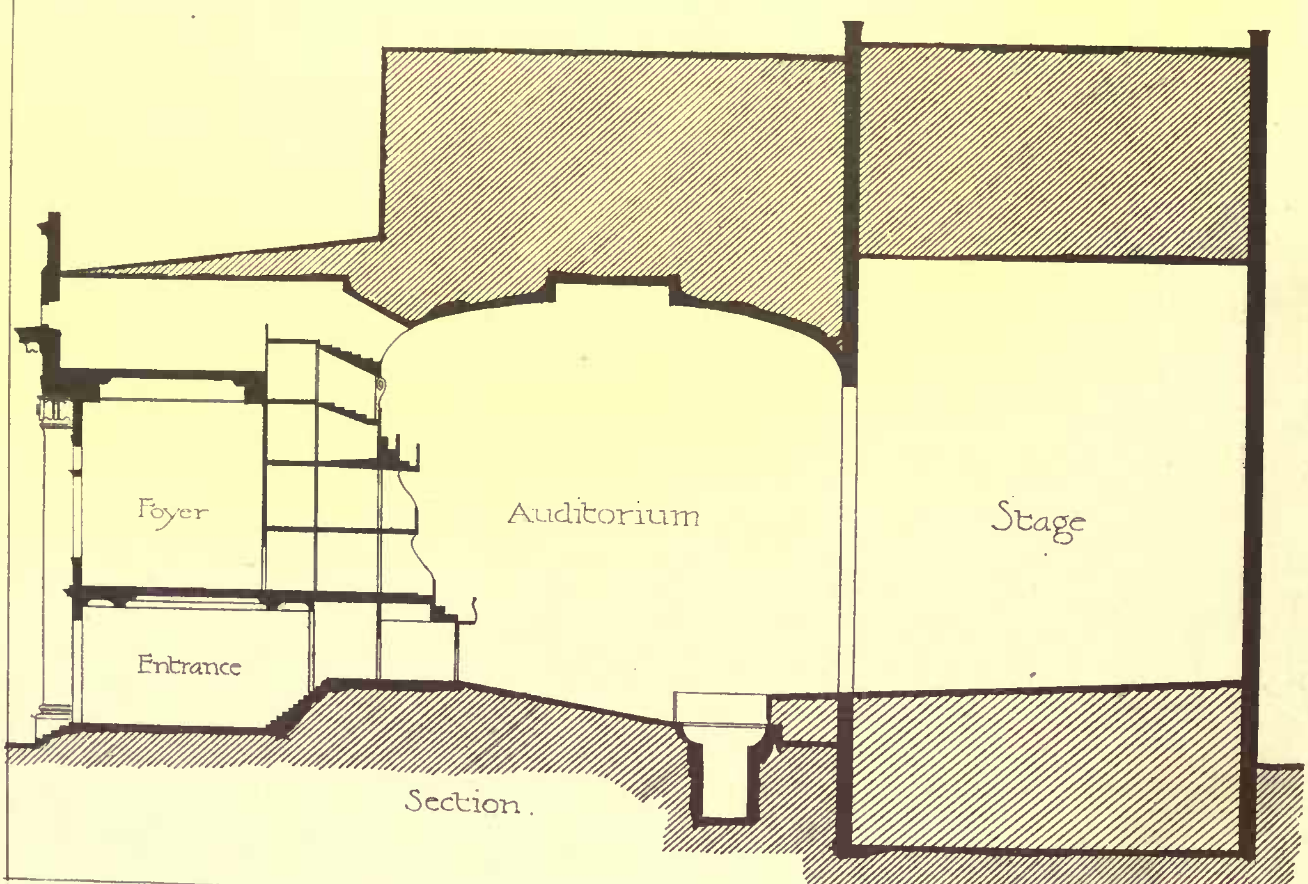
The church at Hastings is not quite so successful as the college, though it is also carefully worked out to suit a peculiar site. It has a wide nave and chancel with apsidal end, vaulted throughout at the same height. The buttresses are worked in with the narrow aisles so as to give them, on plan, the appearance of a series of side-chapels. The west end is low and almost entirely taken up with a large late tracery window. The ground falls away so much towards the east as to provide roomy vestries, etc., under the chancel, and give great height to the apse. The style is late Gothic; all these college and church drawings are from the facile pen of Mr. Raffles Davison, so that the designs rather gain than otherwise from his charming rendering of them.

Close to these hang the works of Messrs. Ernest George and Peto, "Redesdale - Hall," Moreton-in-Marsh, a clever market-hall, founded on the old low country type, with an open arcaded ground-floor. "Glencot," Wells, a Devonshire-looking house of late Gothic, "Dunley Hill," Dorking, another country house, more peculiar than beautiful in some of its features, especially in the tall, narrow porch, which is really all out of proportion, and last but not least the proposed rebuilding of "The Albemarle Hotel," Piccadilly. The latter is very clever and will import a bit of old low country work right into the heart of fashionable London. These works are all in their architects' well-known style, including their mannerisms, and are rendered in brown-ink and color with all Mr. George's dash and power of drawing. There is such a sameness about them, however, that somehow the interest falls off a little after so much of it. There is more the feeling of straining after the picturesque instead of letting it come naturally, than we should like, as if it was all done for the sake of doing it. The market-hall errs least in this respect — it is very good indeed, though the tower is a little bit weak.

Farther down Piccadilly than the hotel just mentioned, "The Junior Athenæum Club" are making additions to their premises, by Messrs. Williams & Stephens. Their present club-house is a famous mansion erected for Mr. Hope in a refined type of French Classic. The additions are fussy and quite unworthy the old work, it is just as well they are up a side-street. Bay-windows may be very desirable features in a club, but here they are being done to death.

Mr. John P. Seddon, sends a large drawing for the rebuilding of





Plan of the Opera Comique
(Salle Favart)
Burned May 25th Paris.

American Architect and Building News, June 25, 1887.

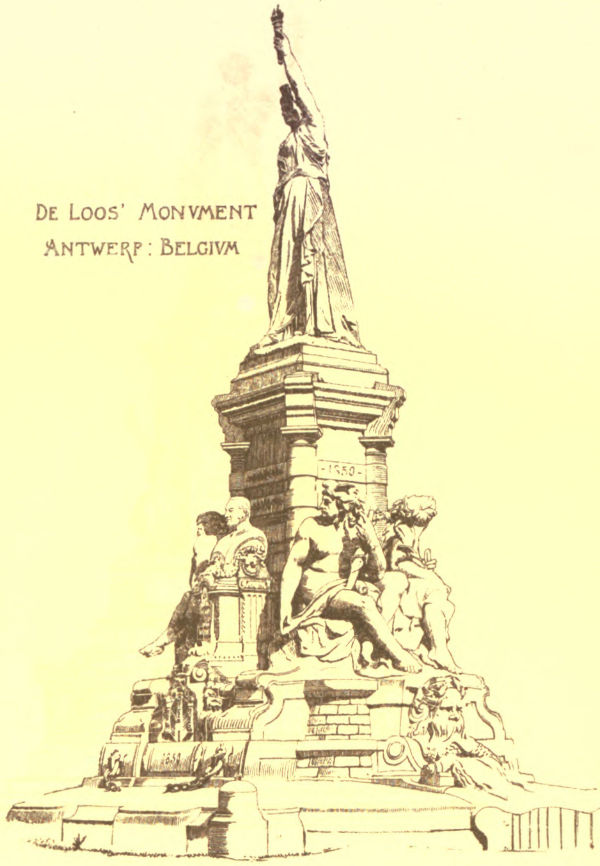




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NATIONAL



DE LOOS' MONVMENT
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GERMAN NATIONAL MON:NT
IN THE NIEDERWALD NEAR RVDESHEIM ..
ON THE RHINE :



STATVE OF "LIBERTY
M. FREDERIC AVGVSTE . BA

…MONUMENTS



LA·REPUBLIQUE FRANCAISE
PARIS: (AS FIRST DESIGNED)
M. L. MORICE SCULPTOR

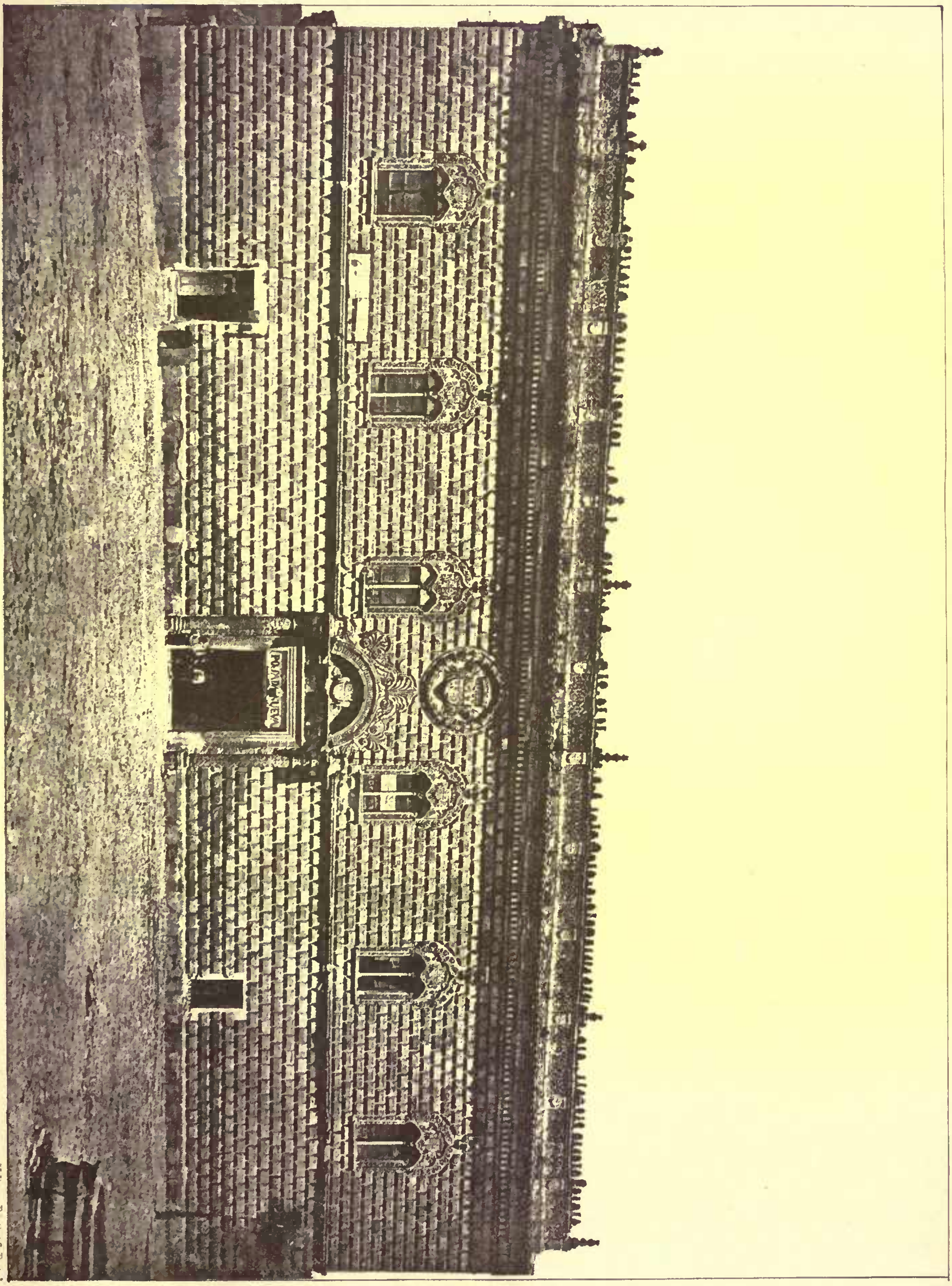


LA REPUBLIQUE FRANCAISE
PARIS: (AS EXECUTED)
M. L. MORICE: SCULPTOR



…DE'S ISLAND NEW·YORK HARBOR.
…SCULP.T Mr R.M. HUNT. ARCH.T

AMERICAN ARCHITECT AND BUILDING NEWS, JUNE 25 1887 No. 600.



Heliotype Printing Co. Boston.

the "University College," Aberystwith, North Wales. It was destroyed by fire a few years since, and this is the restoration now going on. It has a wonderful site on the cliffs facing the sea, is full of picturesque treatment, and is altogether a striking composition throughout. Moreover, it is Mr. Seddon all over, which fixes its style of Gothic at once. Originally built for a sea-side hotel, and afterwards adapted for the college as best it could, it will be considerably improved in this respect now the fire has kindly given its architect an opportunity of which he has taken full advantage to the benefit of the building in every respect.

Mr. Wm. Young sends a longitudinal section of the interior of a "Proposed New Church at Chelsea." This is most interesting as the work of a man so much engaged in Classic. It is in geometric Gothic, of the style so much used by the late Mr. Street — is very well proportioned, carefully detailed, and promises to be a very satisfactory church. A plan would have been useful to explain the arrangements which the section leaves rather vague.

"Claines Church," Worcester, enlarged and restored, by Mr. Aston Webb, is one of the most careful and well-studied works of the kind we have seen for a long time. It is a pleasure to see such restoration as this. The same remarks apply to Mr. Arthur Street's new chancel and transepts to Dewsbury Parish Church.

Mr. J. J. Stevenson sends drawings of the saloon, drawing-room and library of the Great Orient Liner, "*The Ormuz*,' showing the "revival" has extended to ships as well as houses. This is a very magnificent steamship, quite equal to the great Cunarders.

Mr. A. J. Gordon sends a design for an important Roman Catholic Church in Scotland — in which he has endeavored, with but partial success, to work in Scotch Gothic features and detail, particularly in the tower. It is an effort in the right direction, as nothing is more characteristic of the country than the Gothic of Scotland, but it requires more study and knowledge than is apparent in this design to do it well. The wonder is, such a field has been so long neglected by the Scotch architects.

There are quite a number of beautiful drawings of old work by students, particularly by Mr. Reginald Barratt & Mr. Gerald Horsley; also some more or less creditable designs for stained-glass and decoration, a window, subject "Charity," for Philadelphia, by Mr. Henry Holiday, being amongst the most noteworthy. A good deal of valuable space is, however, taken up by these drawings, which with all due deference to the students and to the allied arts would, we think, have been better occupied by architectural works. The stained-glass designs, it is true, don't take up much space, but on the other hand they seldom rise above the commonplace level. Drawings of old work are also, of course, interesting, but they have nothing to do with the architecture of the year — and we presume it is the object of the gallery to display this first and foremost.

We are rather disappointed that no drawing is exhibited of Messrs. Webb & Bell's Law Courts, at Birmingham, as finally worked out. The contract for this important building has just been taken, so perhaps Mr. Webb will favor us with some views next year. We have already expressed regret that no drawings from the Liverpool Cathedral competition have been sent. The same may be said of the Edinburgh Municipal Buildings competition, which, though in the meantime has come to nothing, still from the nature of the site and the conditions generally, was one of the most interesting of recent times, and ought to have been represented. Perhaps we may be favored with this also next year.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

CHURCH OF ST. MARY OF THE ASSUMPTION, BROOKLINE, MASS. MESSRS. PEABODY & STEARNS, ARCHITECTS, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial and Gelatine Editions.]

NATIONAL MONUMENTS. I. — STATUE OF LIBERTY, NEW YORK, N. Y.; MONUMENT TO THE REPUBLIC, PARIS, FRANCE; "GERMANIA," NIEDERWALD, GERMANY; MONUMENT TO BURGOMASTER LOOS, ANTWERP, GERMANY.

THE announcement of the Grant Monument Association, that it will receive designs for a memorial to General Grant, unsatisfactory as it is, shows that between now and the end of October designers of more or less capacity will busy themselves with this problem. As it may help to render the result of the proposed competition as little unsatisfactory as possible, we propose to publish during the summer some of the monuments that have been erected in other countries by greater or smaller communities in honor of some celebrated citizen or event.

Of Bartholdi's Statue of Liberty it is not necessary to speak. Of the others, the "Germania" at once commemorates the Franco-Prussian war and the formation of the present German Empire: it cost about $300,000 and was unveiled September 28, 1883. As the "Germania" commemorates the foundation of an empire so the Monument to the Republic marks the birth of a republic: it stands in the Place Château d'Eau, at Paris, and was unveiled some four or five years ago. The original design, which won in the competition, is shown above the monument as actually executed. These three are strictly national monuments. The Loos Monument is shown simply because the figure of the City of Antwerp, which crowns the group, harmonizes with the crowning statues of the other monuments. Burgomaster Loos received this civic honor because during his term of office and through his efforts the Scheldt became a free river.

CHEAPSIDE, LONDON. AFTER AN ETCHING BY S. MYERS, FROM A DRAWING BY R. A. GILL.

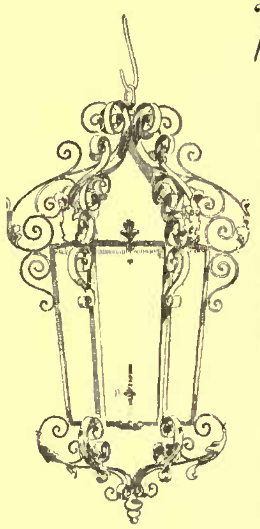
THE OPÉRA COMIQUE, PARIS, FRANCE.

IN compliance with a request, we publish the plan and section of the theatre which was burned with such disastrous results to life a few weeks ago.

FACADE OF THE PALACE OF THE POSADA, COGOLLUDO, GUADALAJARA, SPAIN.

ON THE RELATIONS OF ARCHITECTURE AND THE HANDICRAFTS.[1]

"Watchman, what of the night?"



ALTHOUGH the relations of design to the handicrafts is of deep concern to us, and is likely as time runs on to become the problem of problems, yet there is much in the present state of things to hide it from the sight of such as care not to confront it.

So long as clever and interesting designs can be turned out, such as were seen in the photographs of modern buildings forwarded the other day to the Adelaide Exhibition; so long as historic art has the same enthralling interest for us, and for the young eagles we hatch that it has now; so long as Her Majesty's mails afford us such cheap and ample facilities for keeping up our relations with the craftsmen who have the honor of more or less faithfully representing our ideas in the buildings we are rearing in various parts of the country; just so long may we evade this question if we will. It does not visibly obtrude itself in such peremptory fashion that we are bound to face it at once. We may keep our skeleton safe locked in the cupboard a little longer till we have more courage to face it.

The question is so new and unparalleled. We have kept it hitherto dark from the critics, who worm out most things; and there are possibly such ugly issues hanging to its tail that we are naturally disinclined to touch it. It is not that we are not a bit uneasy about things at times. We cannot but feel that, with all its merits, our design fails to correspond in many vital points with all good art that ever was. There are two ways of drawing a horse, — one starting from the head and the other from the tail; and though the first is undoubtedly the right way, it is not ours. We know that the old ways of art and the old methods of producing art are not our ways and methods. We feel, too, at times that life under the present system of conducting design is an irksome business, — nay, that the stress and strain of it have sent some of our best men into an early grave. Yet to pause and quietly take stock of things seems scarcely possible, — matters move at such a pace nowadays. The mill of Victorian design has had to encounter such strange antics of veering winds, the wheels have had to run so fast, the grain we had to grind is of such various kinds, and the people outside were so mad to get at everything we have turned out, — even before it was properly sorted or bagged, — that, really, what with the bustle, the confusion, the uproar and the dust, we have had no opportunity for calm reflection.

And yet I will be bound to say you *have* had your opportunities for realizing the march of things. We are all diligent students of old art, and old art is never silent to those who will hear. Perhaps, the occasion came in the well-earned pauses of a day's diligent sketching, when, shut in with Nature and her twin sister Art, away from the sound of the grinding-mill, within the precincts of some sequestered old abbey buildings, the desire came upon us to learn somewhat of the secrets of the strength of the old work and somewhat of the secrets of the weakness of our own work. What, — we have then asked, — is that quality in the architecture of old days that stamps it with inherent nobleness? How came it with that inimitable touch that gives it this lasting human effectiveness? From whence did the old men get that subtle alchemy which, somehow or other, seems to have been infused into the dead stone and wood which makes these old walls resound with ever fresh human interest? What is that specific something which is ever present in

[1] A paper by J. D. Sedding, F. R. I. B. A., read at the General Conference of Architects, May 3, 1887.

old design and always absent from new design? What was there in the manner of the making of the old detail that ensures its success, and what in the manner of the making of the new detail that bars its success?

Now the answer to all these questions is, I think, contained within the four corners of our subject. And as to this subject let me say that without wishing to push the significance of our conference upon it to-night too far, I cannot but accept the permission so kindly accorded to me of bringing it before you as witness that you consider it as timely a question as those other subjects down for conference of "Education," of "New Materials and Inventions," of "The Federation of Architects," of "The Registration of Architects."

Our relations with the handicrafts! Well, no one discusses his relations with his relations until matters are uncomfortable. No one chatters of the relations between the members of a family or of a body corporate unless old ties and interests are in danger. It were impossible to conceive of William of Wykeham or Alan of Walsingham, or Christopher Wren, or, Inigo Jones, discussing the relation of architecture to the handicrafts, even though the two last-named worthies were often seen with ominous-looking portfolios under their arms. And why is the notion so preposterous? Is it not that the leaders of design in those days were in active touch with the trades, — the two first-named in closer touch than the other two, — because the architect and the craftsman were not, as now, twain, but one? "So they two went, both of them together."

Now, I am about to ask you to let me treat this subject in what may appear a roundabout fashion: anyhow, it is the fashion in which my roundabout studies of old art have led me to look at it. You see, I assume at once that we must judge of it from an historic standpoint. The past of art elucidates the present: "What has been shall be." The past of art is prophecy as well as history. So I shall hinge all that I have to say upon these four propositions. 1. English architecture is not what it was. 2. The architect is not what he was. 3. The handicraftsman is not what he was. 4. The relations of architectural designer and craftsman are not what they were. In our treatment of these propositions I hope we shall find the key to the situation which causes us uneasiness. Only let me say now, what I shall desire you to remember when I have finished, that this hastily-complied paper lays no claim to completeness, and makes no pretence to adequacy.

1. English architecture is not what it was, — not simply as regards *what* we do, but *how* we do it, — not simply as to the types we have or want, but as regards the initiative and character of design. Architecture under the conditions of these days is becoming more and more a thing of schools and classes, of geometry, of lectures, of manuals of design, of book illustrations, of criticism, of draughtsmanship and sketching, of classification and demonstration. No one will, I think, contradict me when I say that so far as architecture is now conducted as an art and a profession it means *design*, not craftsmanship. Let me give an illustration to explain my meaning. Suppose that a Tory Government, desiring to exercise a little art-coercion, were to pass a Bill for the extermination of all architects and architects' assistants throughout the land! What would happen would be that English architecture would simply lie with the architects dead and buried in the same grave. And if the Bill were to apply "for ever and ever," such English architecture as we have initiated would cease from off the face of the earth. But suppose that some ruffianly monarch had tried the same game on the Innocents of old days, what would have happened? Why nothing would have happened. The effect upon English architecture would have been simply *nil!* because the handicrafts would have carried on things exactly as they had been before. You might as well expect to stamp out the English language by putting to death the professors at the Universities.

Old architecture is craftsmanship or it is nothing. The thews and sinews of old design were in the trades. Old architecture was not what modern architecture is, the creation of the architect's office; it was the creation of the workshop: the workshop was its home, the tradesman's bench was its cradle, tradition was its foster-mother. The momentum of old art came through the trades. Its inspiration came direct from the heart of things, and there were no mediums in the shape of draughtsmen, with their *abracadabra* plans and sections, that prevent the night watches of the honest British workman of to-day. Old architecture is not like the new, a fortuitous concourse of atoms; in spite of its wide range and free development it was, in truth, a compact homogeneous whole, where nothing appears suddenly and without preparation, and nothing disappears until it has played out its part and fertilized the ground for that which takes its place. The style of old architecture is far-reaching tradition. It was nurtured on the sustained enthusiasm of successive generations of tradesmen. It was developed sympathetically and coincidently by men who in their handling of things could maintain firm hold on the past, yet keep their developments so closely neck and neck as almost to suggest the existence of a sort of art-telephone by whose aid the schools of workmen far and near were made aware of the tune going on, so that all alike could be simultaneously working at the same theme or *motif*, yet without restraint to local genius, or prejudice to local necessities.

Old architecture was, above all things, local in its practice and development. Its strength was to sit still. It was not, as ours, an art of excursions, — an art carried out by architects always on the wing, who, like Ulysses, after his long roaming, can say, —

"I am a part of all that I have met."

Old detail was applied by the craftsman who invented it, and was not drawn out by a draughtsman situated, it may be, hundreds of miles from the building being erected, who could have nothing in common with the workman, and no other mode of communicating with him than Her Majesty's mails supply.

Old detail was the product of a fertile field. It passed through the brain of a horny-handed workman, deep skilled in the lore of the trades, and rich with the mellowed harvests of by-gone days. It did not, like modern detail, owe its origin and such charm as its possesses to the volunteer notions and precocious maturity of some masterful soft-handed occupant of an office-stool, whose practical knowledge may not always equal his aspirations.

In regard to this matter of the propagation of architecture by schools of workmen, I will trouble you with a few illustrations taken from British examples, as I wish to trace things home to ourselves to-day.

The effect of the old schools or gangs of workmen is seen in two ways: 1. By the distinct types or varieties of types that prevail within a given area. 2. By the recurrence of similar or identical details in distant structures, which marks the wanderings of gangs who carry along with them the mouldings or plans used by them at their last or previous jobs.

Mr. Street, in his masterly report upon Christ Church, Dublin, incidentally mentions an interesting example of this in the splendid abbeys of the counties of Cork, Limerick, Tipperary, Kilkenny, Wexford, Meath and Down. He says, "It is not as works of art worthy of attentive study that they interest me so much, as the way they illustrate the manner in which art was carried from land to land in the Middle Ages. The feature in question is this, — I find in these buildings the most unmistakable marks of their having been erected by the same men who were engaged at the same time in England and Wales." Of Christ Church, Dublin, and St. Canice's, Kilkenny, Mr. Street observes, "These two churches possess certain features so peculiar and so exactly like what we see in St. David's, Llandaff, Wells Cathedral, and Glastonbury Abbey, that they *must* have been erected by the same troop of workmen, and from the designs of the same architect."

It was, I may remind you, to Mr. Street also that we are indebted for the discovery by internal evidence that Stone Church, Kent (which he handled so ably in his restoration) was the handiwork of masons from Westminster Abbey.

We must all, in the course of our studies or professional work, have come across instances of the same kind. I will give a few that have fallen under my own observation. To cap that of Mr. Street's, I may say that I find the handiwork of the builders of Sherborne Minster in Crewkerne Church. Again, Tideswell Church, Derbyshire, is a remarkable specimen of fourteenth-century work. We can plainly trace the Tideswell arcades, windows, doors and porches in Chesterfield Church, erected later on; and I can further run these identical features to ground at Tamworth, some long way off.

Of the repetition of the same designs and details in the same county, I may mention how the noble Perpendicular towers at Isle Abbots, Huish Episcopi, and Bishop's Lydeard, Somerset, are so exceedingly alike that, were it not for their different surroundings, you would not from your sketches of the three be able to tell "t'other from which."

Speaking of this county, I may recall to your recollection how a gang of Somersetshire workmen put up a completely typical Somersetshire tower at Llandaff Cathedral in the fifteenth century. Further, that another gang of Somersetshire masons built Wadham College, Oxford, in the seventeenth century.

Perhaps it may not be out of place if I here venture to give as my opinion that the vast majority of our parish churches were both designed and built by schools of workmen. To me they represent peasants' art. They are local, not only in regard to conformity to certain types, but local in the thought and character expressed in them. They are of the soil, and made by children of the soil. While the stone of which they are built was quarried in the field hard by, the ideas they clothe were quarried out of the no less home fields of the local peasants' brains. And, for my own part, I like to feel that just as the gospel preached within the walls of our parish churches had its peasant apostles, so the art proclaimed in the walls had its peasant apostles; and I am no less the humble disciple of the one than of the other. What little I know of art I have mostly got at the feet of the humble, but immortal, peasant craftsman of olden times. The critic, who is 'cute or nothing, tells us that the marks of irregular composition and crude handiwork found almost invariably in Gothic buildings are essential to the style, and that they are there because they were purposely put there, forgetting that these traits are but the accidents of the work which are found equally in Roman or in any other phase of art where the culture of the workman tallies with this case. It were best to drop such theories, and to see in the simple *naïveté* of these buildings, and in the unexpectedness of their composition, only the state of the handicrafts of the time. Art has its undress as well as its full dress Academy costume, and here we have but the product of men whose invention was in their finger-ends, whose imaginative grasp was not great, who were ignorant of the rules of selection, and whose work, — delightful and elevating though it be, — has none of the distinction and the *Atticism* of fastidious times. Were architects employed to design our village churches? I doubt it. But if so, methinks that the British architect of the

present day has something to learn from them of the beauty of simplicity, and of the value of restraint in design.

The strongly local flavor of old architecture is, I say, an indirect testimony to the community of effort and art-motive. The distribution of plants and birds in a locality is not more marked in England than the distribution of types of old-world design and handiwork. If the botanist can tell us where to find the bee-orchis or the *Osmunda* fern, or the ornithologist can tell us where to find the stone-chat or the turtle-dove, we architects can tell them where, and where only, certain architectural types are to be found. Nay, we can tell them the marks of borderland influences, — how differences exist, and yet the identity of the original types will still be preserved. We can tell them how a Sussex tower differs from an Oxford tower, and a Derbyshire tower from both. I remember tracing the likeness of the tower of St. John's, Cardiff, to the tower of Gloucester Cathedral, and I found afterwards that the living of the parish was still in the gift of the Gloucester Chapter; so that goes to support the theory that the same gang of masons built both.

Again, we can tell almost by the feel of an enriched bench-end whether it be the work of the tribes of Somerset, or Devon, or Cornwall. Show us an oak chest in Wardour Street, and we can tell in what county it was produced. We can tell at a glance whether the tracery and make of a church screen be of Welsh, Yorkshire, or Norfolk origin. I once went a long journey in the wilds of Cornwall to see what Murray calls "an elaborate screen," and I remember my disgust as I pronounced at a glance that the thing was of Midland County origin. My instinct was right, but it was proved right in a manner I did not anticipate, for later on I broke blade after blade of my friend's knife over the tracery, which, though looking like oak, was in reality Brummagem cast-iron!

Here are a few other testimonies of local schools of art shown by the presence of one type and the absence of another. Thus the barrel roof is the only existing type of roof in Cornish churches. In Devon the type exists, but in a less degree; in Somerset it exists, but in a still less degree. In the churches of these three western counties there is, again, the same peculiar continuation of the nave aisles to the full extent of the chancel, and the aisles almost always have pitched roofs. There are only four instances of clerestories in Cornwall, — at Callington, Lostwithiel, Fowey and North Petherwin. Again, in Cornwall, I know of only two chancel arches, — at Bodmin and at Towednack.

And so with other features elsewhere. If you draw a line from Newmarket to Fen Stanton there is a preponderance of towers over spires in the proportion of nearly ten to one; while at that village the character changes, and were a line drawn from thence through Huntingdonshire and Northants into Rutland, a tower would scarcely be found. From the same School of art influences Oxfordshire houses get their gables and Northamptonshire houses their special types of chimneys. Such methods of local developments of types conduced to the growth of individuality of character.

Another special phase of architecture is that where local types are temporarily colored by foreign influences. This phase is, of course, represented in a wholesale degree in Spain under the Moor, or in Flanders under the Spaniard, and oddly, too, in Spain when the Spaniards evacuated their diggings, but took Flemish tricks of building away with them. The Flemish stepped-gables, for instance, crop up in Spain. But we must not wander from England, and I will only note two examples here. There is the strong influence exerted over Norfolk and Suffolk art after the wealthy traders had imported Flemish craftsmen to those parts. Again, my rambles in Devonshire have enabled me to trace the work of a small gang of sixteenth-century Flemish carpenters over that part of the country that lies southwest of Kingsbridge road Station. Their work is to be found in the screens of several churches in that neighborhood. The "grand climacteric" of the school was arrived at in the side chancel screens at Holbeton, but I found their work also at Chivelstone, Kingsbridge and Ugborough. The work is singularly beautiful, and it loses none of its interest by the admixture of foreign and local characters.

2. The architect of to-day, I said, was not what he was. In touching upon this point I shall say as little as I may upon the vexed question of the functions of the architect in old days, and to what extent he corresponded with ourselves. I am led to think that from whatever source the general scheme of a building came, — whether from patron-builder, architect-builder, or master-workman, whether the building were church, castle, country-house, monastery, or cathedral, — the details were left pretty much to the trades.

That the names of the architects are not connected with the traditions of old English buildings does not necessarily imply that the people of the place were unconcerned about the history of their buildings, but it implies, I think, that their erection was a joint-stock affair. Even in Italy, — where one would suppose from books that art was the great business of life, — even there Vasari has to note to how few, especially of the notable earlier buildings, he can assign an architect's name. The reason he gives for this is the then modesty of the profession! He "cannot but marvel at the simplicity and indifference to glory exhibited by the men of that period." Now although one feels that for me to "differ" from Vasari almost parallels the old woman who "differed from Paul," yet in spite of this, and in spite of seeming to rob the profession of the merit of a virtue they can ill afford to lose, I do venture to think that Giorgio Vasari was on a wrong tack here. Is it not a singular fact that whenever a *foreigner* has anything to do with a building, — a man, that is, who is not of the crowd of local craftsman, — we are sure to hear of him? Thus we hear of the Buschetto, "the Greek," at Pisa, of Master Harduin, at Bologna; of Wilhelm of Innspruck, at Orvieto; of Maestro Jacopo the German, at Arezzo; and so forth.

But what I particularly desire to emphasize here is the little influence the foreign architect can exert when his sympathies run counter to those of the craftsmen. How different is it now! The ground-plans of the churches, their proportions, their roofs and their traditional features remain as before, in spite of the foreign "boss." It is only in the window traceries and the form of the arches that he makes any appreciable mark. One swallow does not make a summer. And so Messrs. Giovanni and Tommaso and the rest of the brown-faced workmen complacently smile at the foreigner as he shakes his shaggy locks and rolls out his Germanic oaths: they know that the running is in their hands. Gothic is queer stuff to them, but they know that Gothic is not Gothic when smothered in Classic clothes from top to toe. And we know it too.

To revert to English work. I would, for the purposes of this paper, divide English design into three phases, each phase representing a different relationship or degree of relationship to the craft. 1. There is the art which ranges from the earliest times down to the Classic Renaissance of the sixteenth century. 2. The art which ranges from the introduction of the Classic to the Gothic Renaissance of this century. 3. The art which represents the Renaissance of the Gothic and of the Renaissance now going on.

The first phase expresses more exactly than the second what is the true native style of the English people. I do not say that it is the better or the worse for that. The second phase is English enough, yet English with a difference. In the first, or Gothic phase, we have art as it sprang spontaneously into existence, fresh and untarnished from the rock of the genius of the people, and here architects — who, in the history of English architecture, have mostly been employed as translators — were a superfluity except in a big effort. There was no call for the translator in the development of the Gothic; it was the common people's language.

In the second phase we have a certain interference with the methods of origination — a certain tampering with the springs of design at their source. There are, as you know, two sorts of interference with deep-rooted design — the accidental and the wilful. Interference like that of the Moor in Spain or the Spaniard in Flanders was accidental, but the interference that I now speak of was wilful, and here, as was the case with the Gothic revival, it was carried out by "superior persons." Men travelled more, and discussed and desired to reproduce at home what they had seen abroad. The influences of travel and culture upset, as far as they could, the traditions of the workshops. Kings and courtiers, scholars and churchmen, cast their eyes about them abroad, and when they got home threw all the weight of their wealth and patronage to uprear the new Classic. Naturally enough the situation demanded the professional services of masters of design, like Holbein and the ubiquitous John Thorpe. At first, I suppose, you could have counted "the profession" on the fingers of one hand. But there were brighter days in store. Gothic churches might be designed and built, as we have seen, by peasant tradesmen, but not so Elizabethan mansions. These must have some of the grace and elegance of the buildings from whence their *motif* came. You will, I think, agree with me that the Elizabethan and Jacobean styles need wealth to build, and refinement to design, or the quality of dignity essential to their proper representation is absent. They represent Academic art, courtly art, an art of distinction and selection. Renaissance art needs a well-furnished mind, learned in literature, apt at Classic allusion and at rendering antique symbolism. Here clearly is an art that demands the professional services of an architect.

Now the point I am coming to is that, in spite of the difficulties of the situation as regards the character of the architectural design then needed, and, in spite of the disparity of culture of the designer and the craftsman, their relations are entirely pleasant and friendly. The common workman is not ousted from his old place in relation to the initiative, or, at all events, to the *development* of design. Design did not all at once begin, as it did with us at the time of the Gothic revival, to be *paper* development. Of course, you may explain the situation by reminding me of what I know already, that the designer then was only a specialist, and specialists are never up to much! You may say that the architect or the patron-architect knew precious little about details, and so left the workman to supply his deficiencies. But that does not cover the whole case. Even a specialist may be a master, too, occasionally.

What we may infer from observation of the Early Renaissance work is that, by some means or other, Tom, Dick and Harry, who had "allers done Squoire's work," were made acquainted with the round arch, pilasters, balustrades and friezes, and they took kindly enough to them, and worked "overtime" in the evenings, scheming fresh planes for "them tricksy new-fangled mouldings." But the Classic imagery stumped them, as we see by our old country houses to this day. Here was clearly a case for calling in their betters.

But while things moved so sweetly in the yards, the "superior persons" who wrote about art were not content. We all know, and like no less, that dear old pedagogue John Evelyn's "*Parallels*," which, as you may remember, also contains the significant "Explanation of certain *Terms* particularly affected by *Architects*," which looks very like making architecture an exact science. In his "*Apology for Antient*

Architecture," Evelyn refers with something like scorn to the "simple workmen, whose trade dwells all upon their finger-ends only. But," says he, "we shall not appeal to such arbiters as these; there are others to be found that, having their first studies well founded on the principles of geometry"—we know the sort of thing that follows.

The architects of those days, however, were not going to be led by the nose by the "superior persons." They were not going to kill the goose that laid the golden eggs. The "simple workmen whose trade dwells all upon their finger-ends only" had an honored and a conspicuous place in the making of English Renaissance design. The architect did not swamp the craftsman or destroy his individuality, or play the masterful dictator by putting a clause into his specification to the effect that "No moulded work, or work involving the design of the architect, to be put in hand without previous application to him for, and supply by him of, the necessary full-size and detail drawings." This piece of supreme folly aud suicidal presumption it was left for the architect of the nineteenth century to inaugurate.

Time and your patience would fail me were I to go properly into this phase of the subject, or to show how even an old stickler like Thomas Tresham lets the workman work his will, as where, in the Triangular Lodge, he lets the local mason put in the local crocketed gables seen in Perpendicular work at Higham Ferrers; or at Rothwell and Lyveden, the familiar Tudor features of angle staircases, ranged heraldry, bay-windows, etc.

To see concisely and easily what were the relations of the architectural designers and craftsmen, we cannot do better than go to Oxford. Take such work as Fox's at Corpus (1516), or Wadham (1613), or Pembroke (1620), or the various phases of Renaissance at St. John's, including Inigo Jones's inner quad (1635). And what I would ask you to specially notice is that all the work—in spite of its Classicisms—is as *Gothic* as New College, as fully *local* (barring a Somerset touch in Wadham) as Merton or Magdalen, as fully *English* as it well could be. It matters not the date of the Oxford buildings, they are *Oxford work.* The door to the qualities of all alike open to one master-key. The big-sounding architects' names attached to their initiation do not count for very much. Old architecture, as I said, is craftsmanship or nothing, and this proud city of learning is indebted for her architectural triumphs, whose fame is in all the world, to the "simple workmen whose trade dwells all upon their finger-ends." Verily, there is a place in the exercise of our craft for learning, geometry, and refinement just as there was a place for the polished weapons from Saul's armory in the battle against the Philistines, but none the less is there a place for the native invention of the local genius with his five smooth stones out of the brook of common local art. Saul may slay his thousands, but David—said the singing women—his ten thousands. Even Inigo Jones, with his big name, big individuality, and big reputation in "the profession" submits like a man to the embrace of the genius of the place, and lets the local handicraftsman have his say in the details, even to the plumber who made those magnificent stack-pipe heads you and I have sketched and tried to reproduce.

Of the art of the third phase of this section of my subject—the art of the Gothic and other revivals—I need only say, at this moment, that these revivals arrested workshop traditions. The revival was also a revolution in which the poor decrepit handicrafts which represented tradition went to the wall; and the Voltaire of the revolution—the writer who with his pen shook down the whole fabric of tradition by appealing to the individual's own sense of beauty—was Mr. Ruskin.

My next point (3), that the handicraftsman is not what he was—in skill, practical knowledge, design, or imaginative talent—needs, alas!, but little argument to prove.

In judging of the architecture of old days—say of Italy in the fifteenth century, of England or Germany in the sixteenth century—you do not look merely at the plan or scheme of the building, but at their fittings and furniture inside. The bare walls are but the frame for the picture, the casket for the gems inside. In other words, we look at what is being turned out by the craftsmen all round. The touch-stone we apply to test the merit of a nation's art is the condition of the trades. We go to the minutiæ of the mason's, carpenter's, smith's, weaver's, painter's, plasterer's work to tell us the state of architecture. On visiting an old house the stamped lead-work on the water-butt at the door that the vine-leaves will soon shroud from sight, the big stack-pipe head that two families of sparrows had appropriated during this long bout of dry weather, the moulded door, the brass-work on the mantelpiece, the clock, the panelling, the plaster-ceiling, the chairs, grates, staircase—in fact, everything your eyes light upon, bears witness of the then state of architecture. It is different now, when the British matron has to go for her home-treasures to Tottenham-court-road, or when the British parson has to yield himself a prey to the blandishments of an eminent Birmingham firm or to the eloquent self-adulatory notices of the Barnum of the West.

Of course the handicrafts and architecture went to the wall together, and were both in an equally bad state at the end of the eighteenth century. The handicrafts will not prosper without proper encouragement and proper nurture: and the humdrum existence, the bad wars, the niggardly art-patronage, the mechanical utilitarian spirit, and the Quakerish religion of the times, all contributed to their downfall. Think of the Dutch doll-houses people had the face to put up then! See, too, what Puritanism had done for England when the relations of art with religion were represented by some such entry in the church-wardens' account as this: "To altering the Commandments, to mending the Belief, and to making a new Lord's Prayer, 4*l.* 10*s.*"

Now, in making this broad and not very complimentary statement about the handicraftsman of to-day, I blame him not. I pity him from the bottom of my heart; for I know how the stars in their courses have fought against him. The domineering architect, the scornful critic, the capricious public, the steam-joinery builder, all these and many more things are against him, and all have contributed to degrade him. But when the parson explained to the rustic the three causes for a certain thing the latter forcibly remarked that "A hog h'aint got three fathers"! So here there must be one great cause for the downfall of the craftsman from the high estate he held in better times, which I have done my best to bring before you: and I take the root of the mischief to be this—the lack of definite art-types. No trades can exist—no, and no architecture can live—without these. Workshop traditions were everything to the trades in old days, and nothing lasting can come out of our design till the workshops again have their stock-in-trade of types. The trades live only by the circulation of good, stable art-*motifs* and types. These are their life-blood. Check their flow and the trades languish; stop their flow and the trades die.

Now I have dwelt upon the Classic Renaissance thus long and fully so that I might be the better able to point a moral for ourselves in our conduct of the Gothic and Renaissance revivals now going on. And there is quite enough similarity in the conditions of the times which saw their inauguration to warrant comparison. Each came on the heel of a decrepit art that after a process of soft autumnal dissolution was now seemingly at its last grasp. Each found a ready welcome from art patrons and designers. Each found the world eagerly looking for it as a sick man looks for his tonic.

There has been a tendency lately to speak disparagingly of the Gothic revival. Too often have I been guilty of this, because one had a vague idea that the Gothic revival slew traditional art and ruined the handicrafts. But this is scarcely fair. To be honest, there was nothing that was necessarily destructive to the handicrafts in the mere revival of the Gothic. Nor was it the Gothic revival that did the mischief, but it was the idiotic, needless, abominably selfish way in which it has been conducted. The Gothic revival has been a glorious boon to paper design, because paper design was all we architects cared for. The carrying forward of the Gothic revival has been no boon to the handicrafts, because it was not our game to make it so. The craftsmen went down as the architect went up. The Classic had been an effective tonic and stimulant to the decrepit Gothic of the sixteenth century, because the tonic reached the right persons: and the Gothic was not an effective tonic to the decrepit Classic of the nineteenth century, just because it didn't reach everybody, and was only applied to the paper-designer and not to the handicraftsman.

I now come to the fourth point: The present relations of architectural design to the handicrafts. When I approach it, and ask for myself and for you, "Watchman, what of the night?" I am bound to say that I dread a too candid reply. Of course, we are accustomed to carry on design in such a grand, creative, cosmopolitan sort of way, that some may resent even the notion of inquiring as to the march of things. The view from this Olympus of ours at Conduit Street, cold and bare though its top be, brings home to us a sense of being monarchs of all that we survey. The very photographs sent to the colonies demonstrate this, and I am sure the natives will have sense enough to see it too. But in a jubilee retrospect of English architecture, we should have to go farther afield, and note such noble works as Barry's Houses of Parliament, Scott's Colonial Offices, Burges's Cork Cathedral, Street's Law Courts, Shaw's "Adcote" and his "Alliance" offices, Waterhouse's Manchester Town-Hall, Pearson's Truro Cathedral, Bodley's Hoar Cross Church; to say nothing of Morris's manufactures, that have done more for the workshops and the home arts of England than the efforts of all paper-designers whatsoever.

We know, then, how great is our inventive power; yet if we may dare to be honest, we must own that this gorgeous garment of Victorian art is, after all, but a patched-up thing. Its tricky devices, delightful though they be, show no community of art-motive and effort in the troop of the designers; the designs are anything but all of a piece woven through and through. Ah! what waste of brain-tissues is here! What specious success does not this art represent! In what an abnormal state must design be to admit of such concoctions! Yes, verily—

> "The time is out of joint; oh! cursed spite,
> That we were born to set it right."

At the outset I hinted that our relations with the craftsman who, at our various works throughout the land is extinguishing himself as he distinguishes us, and emphasizing our individuality at the expense of his own—our relations, I said, are only such as her Majesty's mails supply. In other words, we are dictators, and the craftsmen are our humble slaves. Designers are completely out of touch with the trades. Design has run miles and miles away from the knowledge and sympathies of the craftsman, and that clause in our specifications which forbids the execution of any work "involving the design of the architect" signifies that we mean to keep him exiled where he is. Whether we shall ever get things back to their normal state is more than I can tell; perhaps English architecture, with its steam-joinery works and architect's offices, forming one grand

department of science and art, may "bust up" before remedial measures are applied at all.

My closing words shall be a summing-up of the lessons of the situation, and these I put for the sake of conciseness under the head of fallacies that seem to me to underlie and take the heart out of all our modern efforts in design.

Fallacy No. 1.—That museums, exhibitions, schools of art, sketching excursions, manuals of design, photographs of old art, will regenerate the dead handicrafts of England. However these may stimulate the design of designers, I cannot see how workshop types can spring from such agencies.

Fallacy No. 2.—That the multiplication of able designers will regenerate art. We have too many eagles among us already, it seems to me, and too few wrens. The lessons of South Kensington upon this head should not be lost upon architects. Nothing could be less true than that the triumphs of old art were won by paper draughtsmen.

Fallacy No. 3.—That steam joinery is art. I have no faith in that "kittle o' steam" that is fast enabling the builder, with the devil's help, to all but dispense with the services of the tradesmen.

Fallacy No. 4.—That art can be developed by means of our paper designs. Development means freedom to adapt and to combine during the processes of making a thing, freedom to bring a familiar type to perfection by easy stages and "happy thoughts." We never can attain good lasting results by setting men to work in the types of styles of which they have no familiar knowledge and with which they are out of sympathy. Now, whatever your views may be about current politics, there is one point in regard to this matter of workshop union of design and handicraft where you, Sirs, will certainly agree with me, and that is that Home Rule is better than Coercion.

Fallacy No. 5.—That somehow a vernacular style will spring, Phœnix-like, from the ashes of our present topsy-turviness. There is nothing in history that warrants the opinion. It requires an inconceivable miracle to make license into law. It took a God to bring order out of chaos.

Fallacy No. 6.—That adequate working designs can be expressed on paper. Possibly so, yet to me the incidental in old art is its chief charm. To fasten an able craftsman down to strict adhesion to some feeble effusion from an architect's office is to degrade the man. Fancy the Heckington Sepulchre, or the Antwerp Well, or the Hampton Court gates, being evolved out of paper designs and working drawings!

Now, at the bottom of all these fallacies is the one great cause of the lost relations of architecture and the handicrafts. We are bidden by the lessons of history, of old art, no less than by our common sense, and the convictions of our own hearts, to return with all the speed we may to the old fraternal relations of designer and craftsman. The rift in the lute has been too long active to be mended all at once, yet there are obvious ways in which remedies may be tried, and the music of English art regain its sweetness. For architects to cultivate, each one for himself, at least some one branch of the handicrafts, that is one way. To make ourselves and our pupils familiar with the insides of workshops; possibly to turn architect-builders ourselves, or to ally ourselves with trusty builders whose staffs of workmen shall get to know our types and methods — these and many other ways may suggest themselves to you. Granted that the desire is present in our minds, that the Brotherhood of Art is a flesh-and-blood reality to us — granted that the claims of the Esaus and Ishmaels, whom we have driven into the wilderness, are before us — "Love will find out the way," as the old song says, to help him.

But let my last words upon the relations of architectural designer and craftsman be the golden words of the great Master Himself — "He that is greatest among you, let him be as the younger: and he that is chief as he that doth serve."

BOOKS AND PAPERS.

SO much has been written about Millet of late years and his works and his life have excited so general an interest both among artists and laymen that it seems almost superfluous to say much about him, though this excellent biography [1] is so decided an acquisition to the numerous documents extant about him that we cannot refrain from noticing it. Millet was the apostle of poverty; but what his biography does not tell us is that he was born poor, that he was poor all his life, struggling against indifference, neglect, and lack of appreciation; living humbly in his studio at Fontainebleau with none of the luxuries of life and dying as poor as he was born, having fourteen children of whom nine survived him; leaving not a cent behind him, but trusting only to that blind fate which seems to lead so many artists to disregard financial considerations, and think only of the art which means so much to them. Many would be surprised to know with what style of subjects Millet began his artistic career, and it may be said incidentally that he gave comparatively little promise in his early years. The native talent was there but the art did not find its development until he had passed the period when the majority of French artists began to show their decided talents. M. Yriarte tells us that up to the time Millet was forty years old his paintings, which were quite numerous, represented for the most part, bathers with a background of verdure, amorous groups hidden in the foliage, rustic idyls and episodes of country life. The execution of these paintings is quite skilful and the tones are generally agreeable, but he used a great deal of *chic* in his work and was quite lacking in the peculiar quality which in later life made his fame. Millet himself tells that one day as he was standing before the window of a picture merchant, regarding furtively one of the works of his earlier days, he heard a passer-by say to his companion, "That is by Millet the painter who always makes nudities." He was seeking ready money for his needs, but a careless public saw perhaps only a licentious speculation, and Millet, the honest, simple-hearted man whom even a suspicion would hurt, renounced forever painting such subjects.

Our author gives a very good explanation of the reason why Millet's works have never been received by the public or generally admired. He never seemed to care for beauty for itself. Sentiment, a certain grandeur of conception, a kind of appreciation for luminous effects were never lacking in his best works; but he chose by preference subjects which in life one would entirely avoid, dealing with ugliness in poverty, with laborious toil in country life, and often with the repulsive side of human nature. In all the works of Millet there is hardly a single young girl whom one would ever dream of admiring if seen in real life. There is nothing in his work that responds to the perfectly natural desire in the human heart to deck its kind. He never painted an intrinsically beautiful thing, and though his works are so poetic in their character to one who truly appreciates the way he thought, and though his paintings do find a response in the heart of every one who will forget the uncomfortable accessories, we can readily understand that the public which does not care for poetry but asks to be amused, the public which seeks only its gratification and is not willing to exorcise itself into a state of æsthetic rapture, should remain utterly indifferent to the best of Millet's works. Indeed, the painter's best critics admit that he was wrong in so persistently choosing ugly subjects; that it was the rock upon which his talent was apt to break itself; but that in spite of this failing his work is strong and full of interest, simply because nature is, after all, superior to art, and because in painting as he did in such striking accord with nature he was true, and truthfulness in art always commends itself to the artist.

The quantity of paintings executed by Millet is not very considerable. He produced his work with difficulty, working over his pictures a great deal, and never thoroughly attaining his own ideal. He seldom was troubled about the thought, however; it was more the execution. He would fix the silhouette for the general massing of his painting upon his canvass with pen and ink, and then work it over and over changing the tones, infusing into it that indefinite something which makes us forget the homeliness of the central figure, and toiling with it until, if not satisfied, he was at least content with it. Consequently there are comparatively few paintings in existence which bear his name. On the other hand he produced an enormous quantity of sketches, pastels, drawings, etc., and looking them over one is almost tempted to say that he was at his best in this latter vein. His constant seeking for exactness in producing the effects he desired had, of course, its dangers. Sometimes he arrived at a muddiness of tone and neutrality of effect, a sadness of aspect, which make one regret, even in his best paintings, certain emphatic notes which he put into his early works. Moreover, when he had found the absolute emotion that he required, if it did not turn out to be the best that could be wished, it was quite apt to be very poor and insufficient. Men of a character so very decided and original as Millet never make a half mistake; and if his first conception was wrong, the harmony of tones and uniformity of color did little to offset the errors of the original composition.

He died at Barbizon in 1875, at the age of sixty years. He is too modern a painter to be assigned a true place in art as yet. Still, we cannot but agree with M. Yriarte that his talent, great as it was, ponderous in its force and unequivocal in its direction, might have led to much better things could he have found his peculiar line of thought in early life rather than have wasted so many years of his youth in work which profited him not.

[1] "*Bibliotheque d'Art Moderne: J. F. Millet,*" par Chas. Yriarte. Paris: J. Rouam, Editor.

NOTES AND CLIPPINGS.

DEATH FROM ELECTRIC SHOCK. — While our knowledge of the phenomena caused in the human body by electricity is not inconsiderable, we know comparatively little regarding death from electric shock. We find that practical electricians recognize a marked difference in the susceptibility of different persons to electricity, and only employ men to work upon the electric light who, after trial, are found to be not shocked by the ordinary manipulations which are deemed entirely safe. At the inquest upon a recent fatal case, a workman was brought before the jury who had served a circuit of forty-eight lamps, possessing an electric force of over 2,000 volts. Although made insensible by the shock and fastened by muscular spasm to the wire, he was rescued by his comrades. The length of time that he was subjected to this tremendous shock, which was not only the primary current, but the current of reaction as well, was several minutes. He recovered consciousness very soon, and, although his hands were severely burned, he made a good recovery.— *The Medical News.*

The London Hydraulic Power Company.—The London Hydraulic Power Company, of whose undertaking, as it then stood, we gave a full account on page 99 of our thirty-eighth volume, have made steady progress since its commencement, and now extends its operations from the tower of London to Victoria Station, Westminster, on the north side of the river, and from Dockhead to Waterloo Bridge on the south side. Twenty miles of mains are laid, and are constantly charged with water to a pressure of 700 pounds per square inch, the service being continued without intermission day and night, Sundays and week days. The rapid growth of the use of the pressure-water is demonstrated by the number of machines worked by it. These were in

March, 1884	54
" 1885	163
" 1886	348
" 1887	458

In many cases existing pumping-machinery has been discarded in favor of the Power Company's water, while lifts and cranes have been modified to render them suitable for its use. Even if there were no saving attending the new system, the advantage of getting rid of engines, boilers, and pumps in warehouses, offices and hotels, would be a sufficient inducement to insure its acceptance. But in addition to this, there is a great economy, and the cost of the alterations is soon covered by the annual saving and the sale of the machinery which is displaced. Since the company started work the practice of putting pressure-lifts into all high buildings has greatly increased, and there are now over one hundred worked from the mains. In addition to lifts the water is used for presses, cranes, hydraulic engines, and pumping. For the latter purpose direct-acting rams are employed which can be left to run without supervision all night, raising water from wells, or from basements to tanks on the roofs. As the company's plant is comparatively idle at night they offer special terms for the supply of machinery which runs only after the business hours.—*Engineering.*

The Seasoning of Timber.—Timber, when freshly cut, contains from 37 to 48 per cent of water, the kind, the age, and the season of vegetation governing the percentage. Older wood is generally heavier than young wood, and the weight of wood cut in the active season is greater than that of wood cut in the dormant season. Water in wood is not chemically combined with the fiber, and when exposed to the atmosphere the moisture evaporates. The wood becomes lighter until a certain point is reached in the drying-out process, after which it gains or loses in weight according to the variations in the moisture and temperature of the atmosphere. Following is a table showing the percentage in weight of water in round woods from young trees at different lengths of time after cutting:

Kind of wood.	6 mos.	12 mos.	18 mos.	24 mos.
Beech	30.44	23.46	18.60	19.95
Oak	32.71	26.74	23.35	20.28
Hornbeam	27.19	23.08	20.60	18.59
Birch	39.72	29.01	22.73	19.52
Poplar	40.45	26.22	17.77	17.92
Fir	33.78	16.87	15.21	18.00
Pine	41.70	18.67	15.63	17.42

According to these figures, taken from actual trials, there is nothing gained by keeping wood longer than eighteen months, so far as drying or seasoning is concerned. In the woods mentioned there appears to be an actual loss in some and only a slow gain in others after that length of time. The pine, fir, and beech gained moisture, and the others in the list lost only very slightly after the eighteen months passed.—*The Lumber World.*

A Steam-pipe causes Fire by Friction.—A writer in *The American Machinist* describes an instance in which a steam-pipe started a fire by friction. The pipe was against and fastened to a white pine board, and led live steam to a pump on the second floor of a brewery. Near the pump was a grain-crushing machine running almost constantly, which caused considerable vibration of the floor. The writer noticed smoke curling up at one of the fastenings, and thought it was water dropping on the pipe and steaming off; but almost at the same instant there seemed, from the rapid movement of the smoke, a draft from somewhere, the smoke diminished, and a bright flame showed itself on the board and apparently half-way around the pipe. An examination showed that the board was charred about half through, the motion of the pipe had filed off the tinder which had collected on each fastening, and everything was ready to start a fire in the way which we have all heard about; that is, by friction, as rubbing the pointed end of a stick into the body of another. The pipe showed that there had been considerable up and down movement, as it was worn bright and smooth under each fastening.

The Jablochkoff Light in England.—Although the Jablochkoff system of electric lighting never attained the popularity in this country that it did abroad, yet a great many scattered installations were erected and have worked successfully ever since, and even to-day there is no system of arc lighting so well adapted for situations beyond the reach of technical skill as that which surprised and delighted the visitors to the Paris Exhibition of 1878. An inflated estimate of the value of the patents, however, loaded the company with a nominal capital in great excess of its trading operations, which were never very large, and now, in spite of reconstructions, it has ceased to exist as a separate corporation. The business, however, has never stopped, for there are sufficient Jablochkoff plants in existence here to maintain a steady demand for candles, and Continental experience shows that with commercial activity suitable outlets might be found for many others.—*Engineering.*

A Bit of Chicago Enterprise.—The daily papers report a remarkable incident growing out of the necessities for storage capacity created by the recent wheat deal which has just been made known. Beside the tracks of the Chicago, St. Paul and Milwaukee Railroad there stands to-day, complete in every detail, an elevator of 400,000 bushels capacity, where on June 1 there was only a hole in the ground. It was built from foundation to roof tree in fourteen working days, and on the sixteenth day from the commencement of the foundation 10,000 bushels of wheat were placed in one of its bins.

One of the morning papers, in speaking of this achievement, says, that "when the history of the matter reaches the eye of Joe Wiltshire *et al.*, of Cincinnati, they will register their final vow never again to attempt to corner the Chicago wheat market on the basis of its regular storage capacity."

The Artesian Well at Belle Plaine, Io.—The great overflowing artesian well at Belle Plaine, Iowa, which has caused so much trouble and expense to the citizens of that place, has at last been controlled, and the contractor who undertook the work has turned it over to the city. The condition of the well now is that the water flows out through a 5-inch pipe, which can be shut off at pleasure. There is a small leak from a defective joint 20 feet down, but it is comparatively unimportant. This is the first time the great well has been under complete control for nearly a year, when it commenced to spout. Several thousand loads of sand and stone have been emptied into it in efforts to control it. It was a novel feat in engineering, quite a number of experts having been baffled in their efforts to bring the flow of water under subjection.—*Iron Age.*

Exploring the Site of Sybaris.—The ancient city of Sybaris, once the capital of splendid Magna Græcia, is about to be excavated. It is seven feet under the water of the Crati River, under which it has been lying for twenty-five centuries. This colossal work, comparable only to the excavation of Pompeii, will be carried on by Italian engineers and archæologists, under the supervision and patronage of the Italian government.

TRADE SURVEYS

There is less than the usual dulness incident to the closing of the half year's business. Railroad managers and large and small manufacturing interests are completing their estimates for materials and supplies for the last half of the year. Most have contracts out, but there is a general desire to cover further demands before midsummer, because of the impression that prices will harden. What is true of steel rails and bridge iron may become true of other kinds of material. Building requirements are extraordinary. Hardware manufacturers are particularly well supplied with orders for the last half of the year. Urgent inquiries are coming to hand for a vast variety of products entering into the construction of ships, boats, barges, and inland water-crafts of all kinds. In fact, so encouraging are these reports that it appears the industry will soon become a prominent one. Lake crafts are being projected, and several companies have been recently formed to push work in that direction. Then there is activity in locomotive and car building. Locomotive-builders have more orders than they have had for four years, and a recent inquiry places the present output at forty-two per week. The car-builders have been crowded with fresh orders, and there are now negotiations pending for no less than eight thousand coal and freight cars. Milling, mining, and machine-shop machinery, to say nothing of electric-light appliances, and motive power, are all in unusually active demand, and a great deal of new shop capacity is being built. This expansion is particularly noticeable in the West, and is shown in the large number of small shops that have been erected within the past few months, the most important of which have been in the Mississippi Valley. The demands made for pipe, lights, lumber, glass, roofing, for small engines, tools, and the multitudinous equipments of small manufacturing establishments, show that new sources of demand are opening up, and that the enlarging industrial activity of the New England and Middle and three or four of the manufacturing Western States, rests on a firm foundation. In building the usual activity prevails. The Chicago troubles continue, but a large number of the strikers are at work, and other centres remain unaffected. Building material is not being purchased as freely as earlier in the month. Employers in the building trade are seeking to form a national combination against the dictations of trades-unionism, and the workmen are seeking to do the same to increase their power. Neither side will accomplish their purposes, but the effort will create a sort of armed neutrality which will maintain a conservative course of conduct. The nail-makers are groping around in the dark after a secure footing, but mutual distrust and the bitterness of the spirit of competition prevents satisfactory results. Lumber is strong in all lumber-distributing points. Large accumulations are in progress at lake ports and at some interior points, like Albany, Cleveland, Kansas City and Omaha, where the prospective requirements are such as to warrant this course. Stone supplies are increasing under the increasing demand of builders. Slate manufacturers and marble producers have had a good season. Sash, door, and blind manufacturers are full of orders. Manufacturers of house, office, and school furniture are very busy. Planing and saw mills are making good showings. The season will be one of monotonous activity. Railroad building will probably be diligently pursued during the winter because of the placing of large orders for material to be placed during the winter. Earnings, both gross and net, are increasing, and the far Western and Southwestern roads, such as the A. T. & S. Fé Road, are doing the best, showing the effects of the distribution of population in those localities. The anxiety to control large bodies of real estate is evident in the large purchases being made from week to week, in which Eastern capital figures very largely. The bank clearings show a wonderful vitality of trade, considering the influences to which it has been subjected. The more regular and uniform prosperity of the West and South is being gradually assured by the steady distribution of low interest-bearing capital. The outcome of this will be greater building activity next year. Houses and stores and warehousing facilities are scarce in these new regions developed by the railroad construction of the past year or two. The temptations afforded in the West will attract money faster year by year until a financial equilibrium is established, if the extraordinary resources of the newer sections admit of an equalization. The existing conservative tendencies in buying and selling in all departments of trade and manufacturing are healthful, and will help to strengthen confidence. Capital has not been warned or frightened. Railroad management is not to be crippled by any arbitrary powers. Labor is not to be made a threatening factor by anarchic movements. There are no causes, great or small, acting to intimidate enterprise or to lead to a tightening of the purse-strings of the possessors of capital available for industrial development.